AFRPL-TR-68-124-Vol II

AD 839278

FLEXIBLE EXIT CONE
NOZZLE DEVELOPMENT PROGRAM
PHASE II REPORT

VOLUME II
COLD FLOW TEST DATA (PLOTTED)

APPENDIX I

August 1968

Prepared for

Air Force
Rocket Propulsion Laboratory
Research and Technology Division
Air Force Systems Command
Edwards, California 93523

attn: RPPR. STINFO

Thiokol
CHEMICAL CORPORATION
WASATCH DIVISION

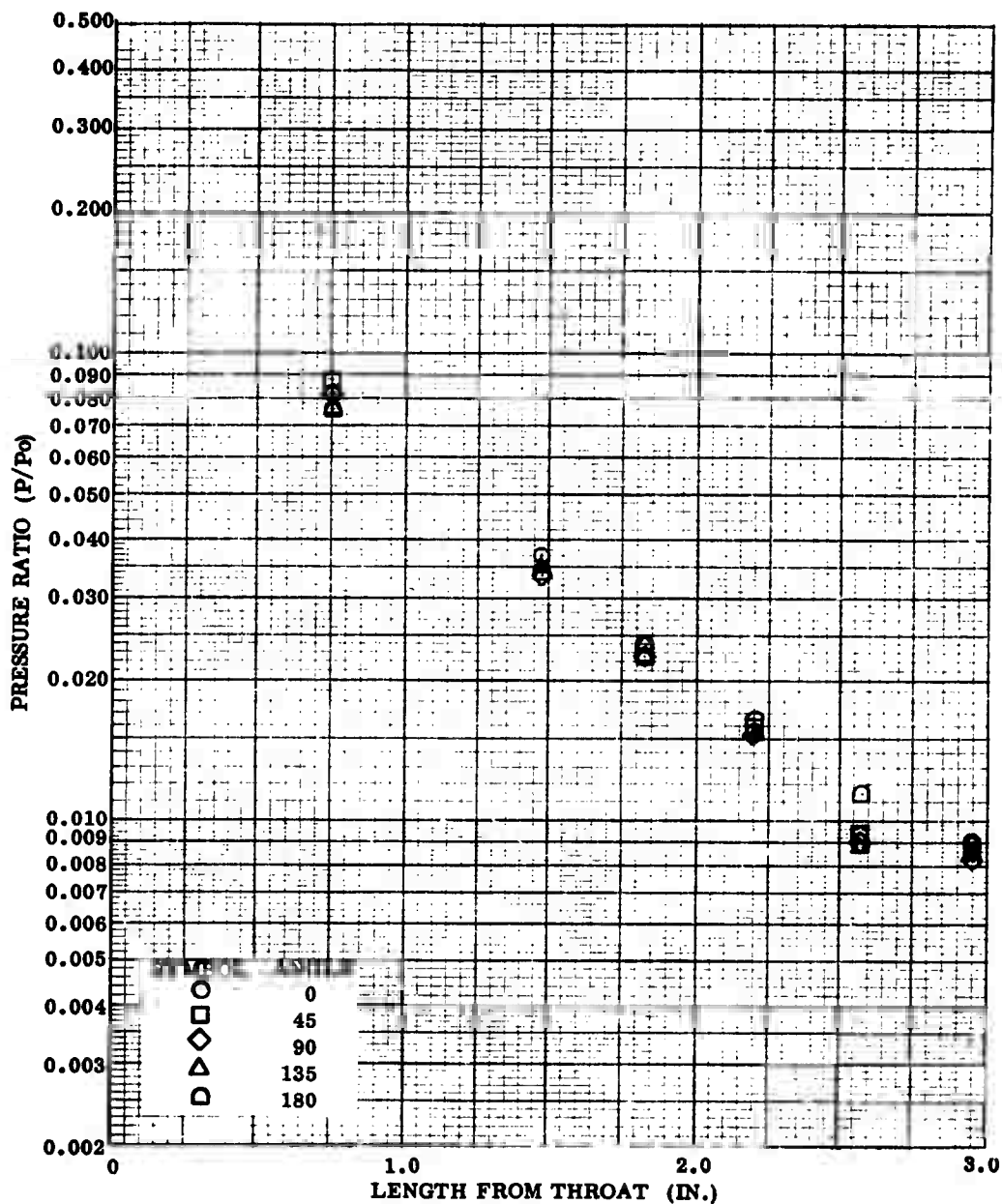FLEXIBLE EXIT CONE
NOZZLE DEVELOPMENT PROGRAM
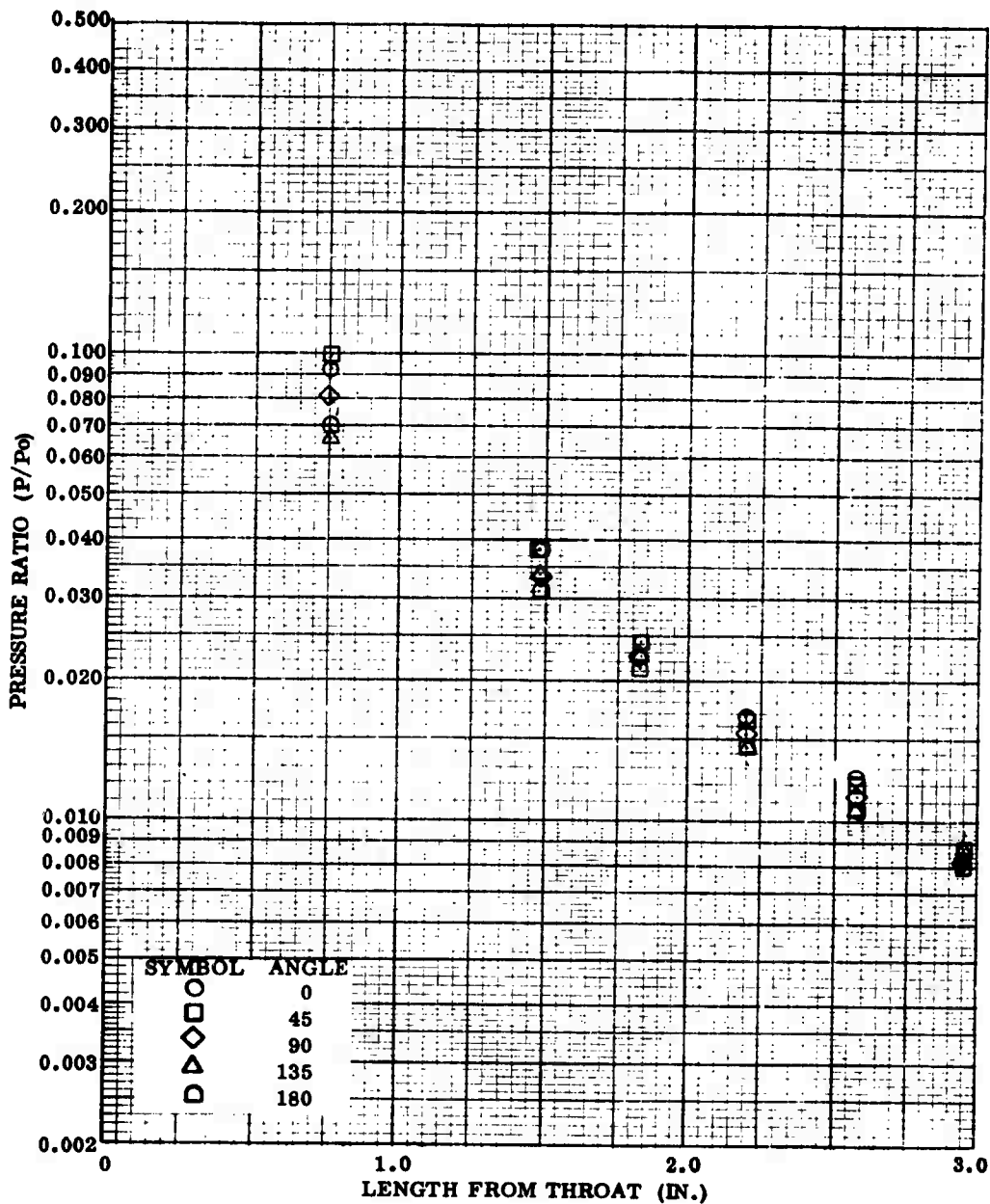PHASE II REPORT

VOLUME II
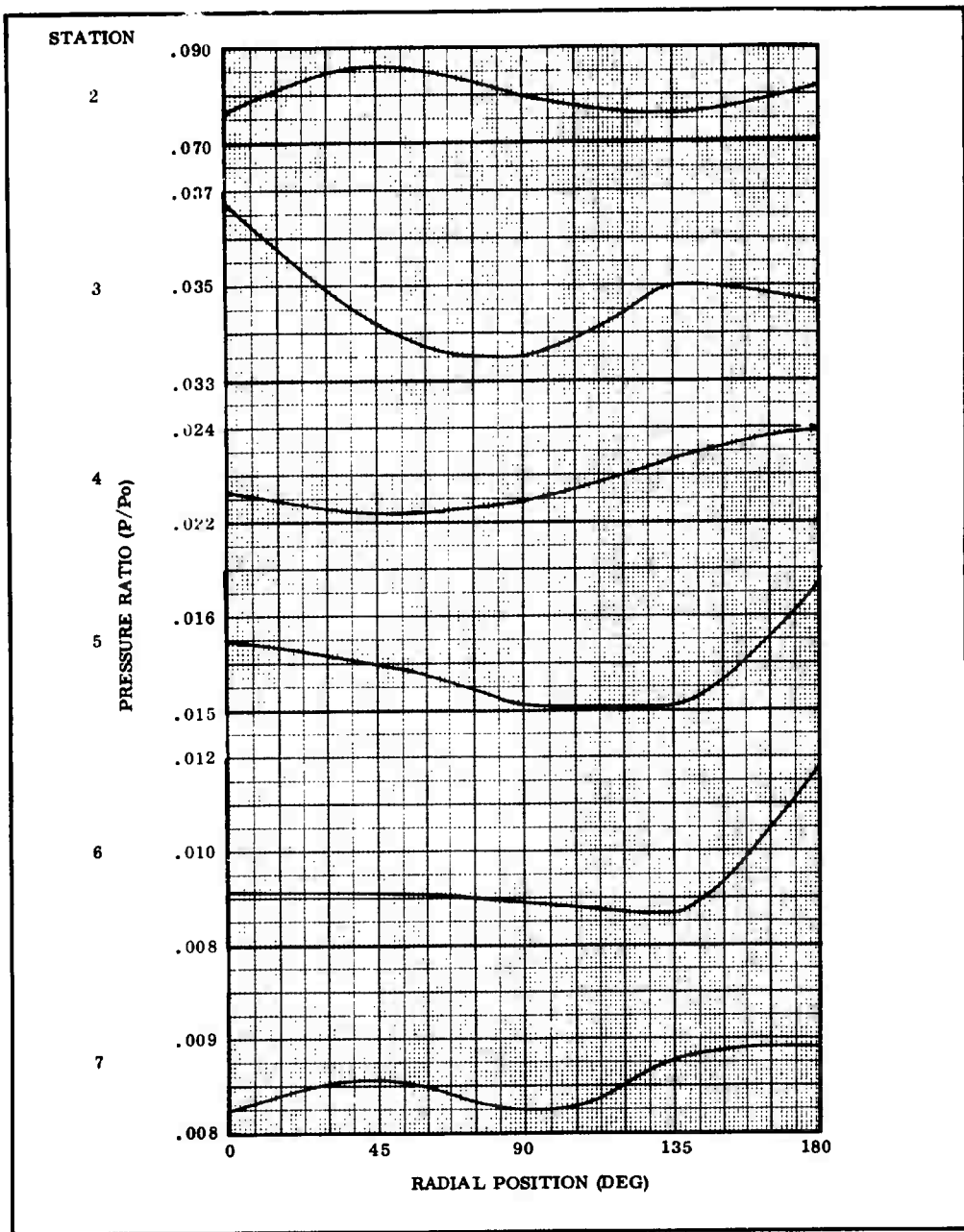COLD FLOW TESTS DATA (PLOTTED)

APPENDIX I

August 1968

Prepared by

THIOKOL CHEMICAL CORPORATION
WASATCH DIVISION
Brigham City, Utah
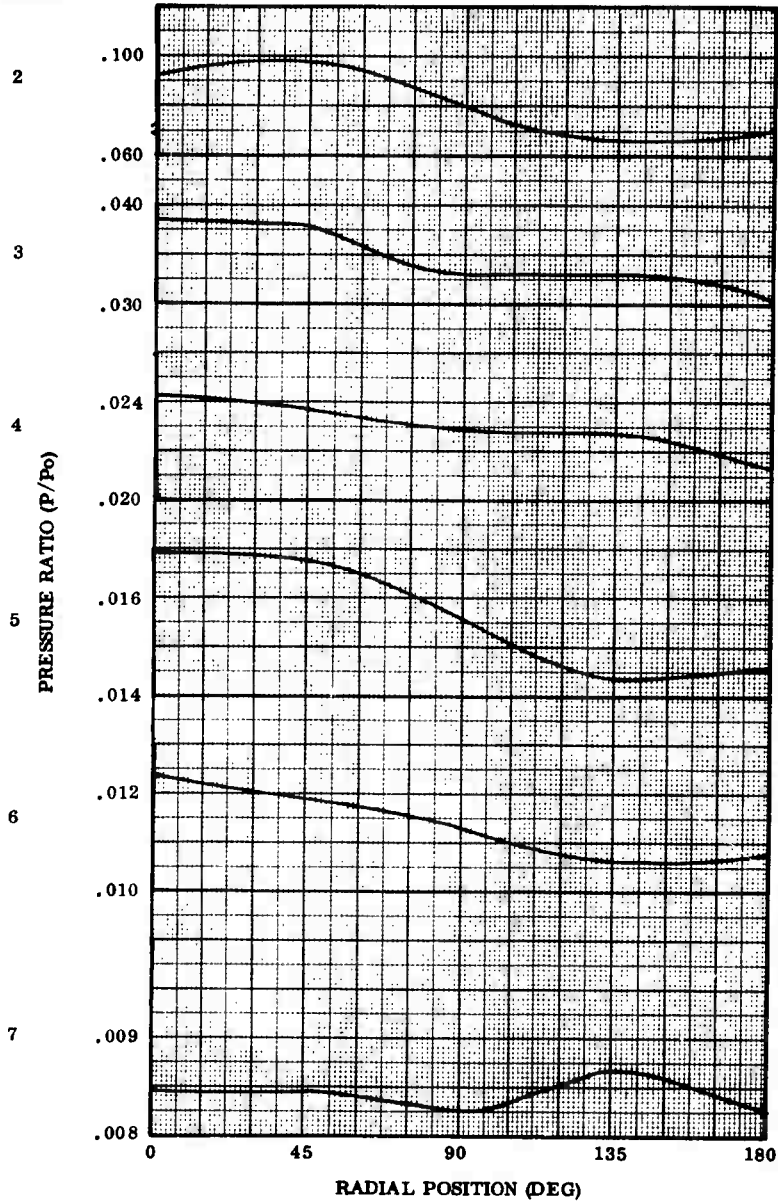
Flex-X Cold Flow Run No. 1 , Vector Angle 0 Degrees

1

Flex-X Cold Flow Run No. 1 , Vector Angle 2.5 Degrees

Flex-X Cold Flow Run 1 , Vector Angle 0 Degrees
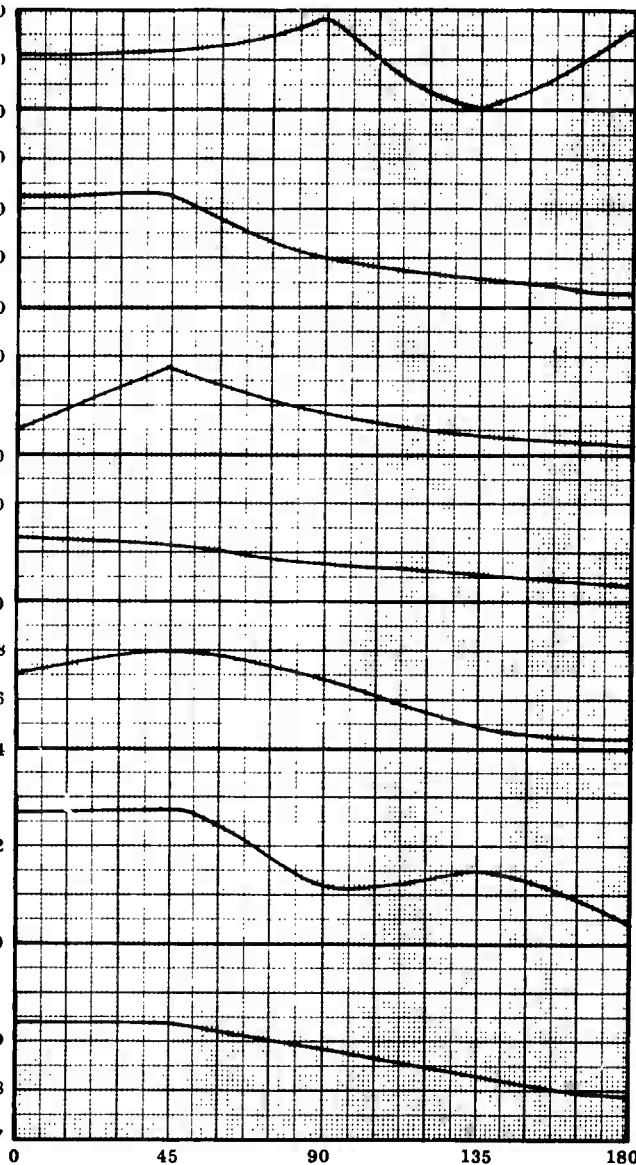
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Flex-X Cold Flow Run 1, Vector Angle 2.5 Degrees

4

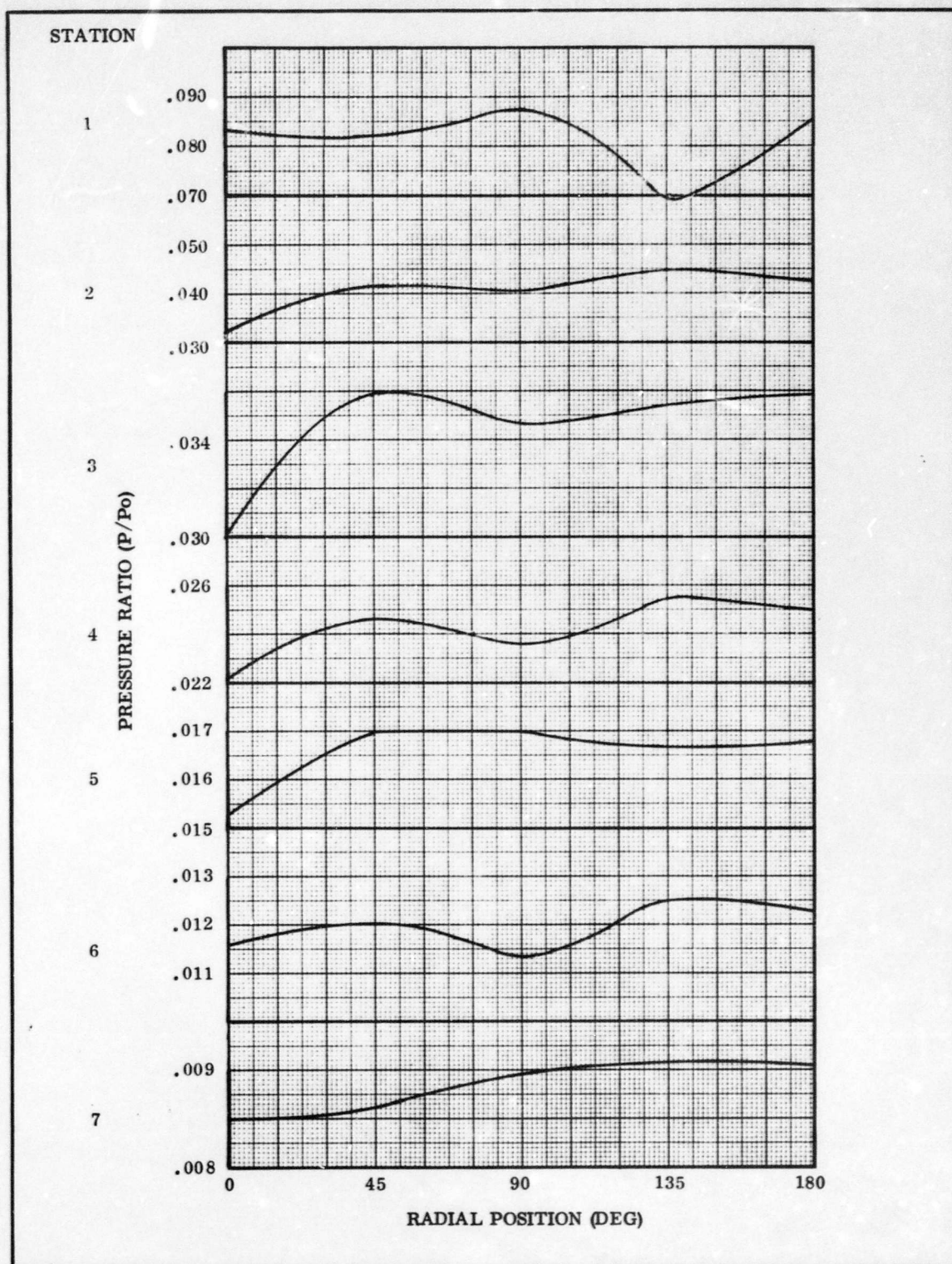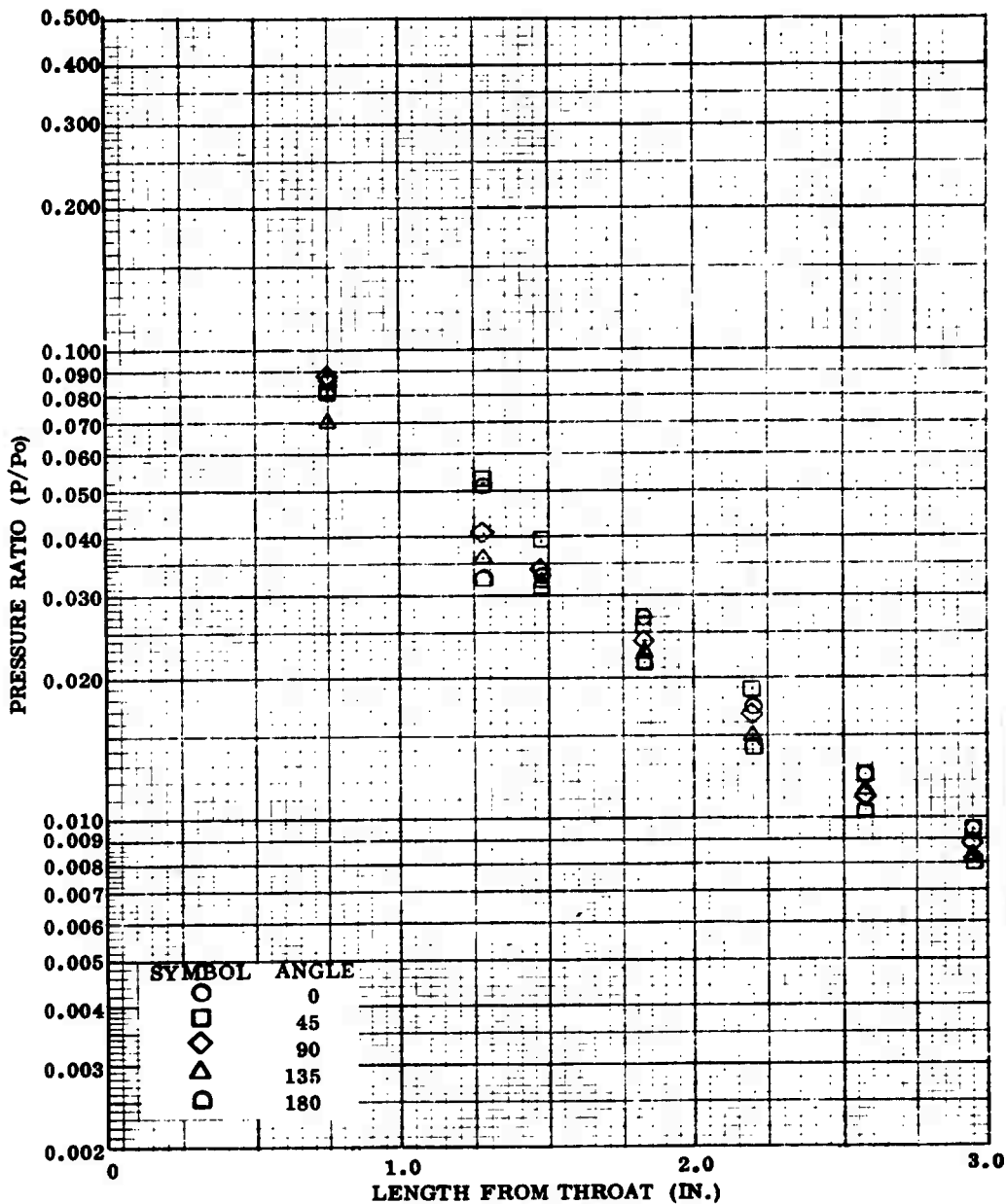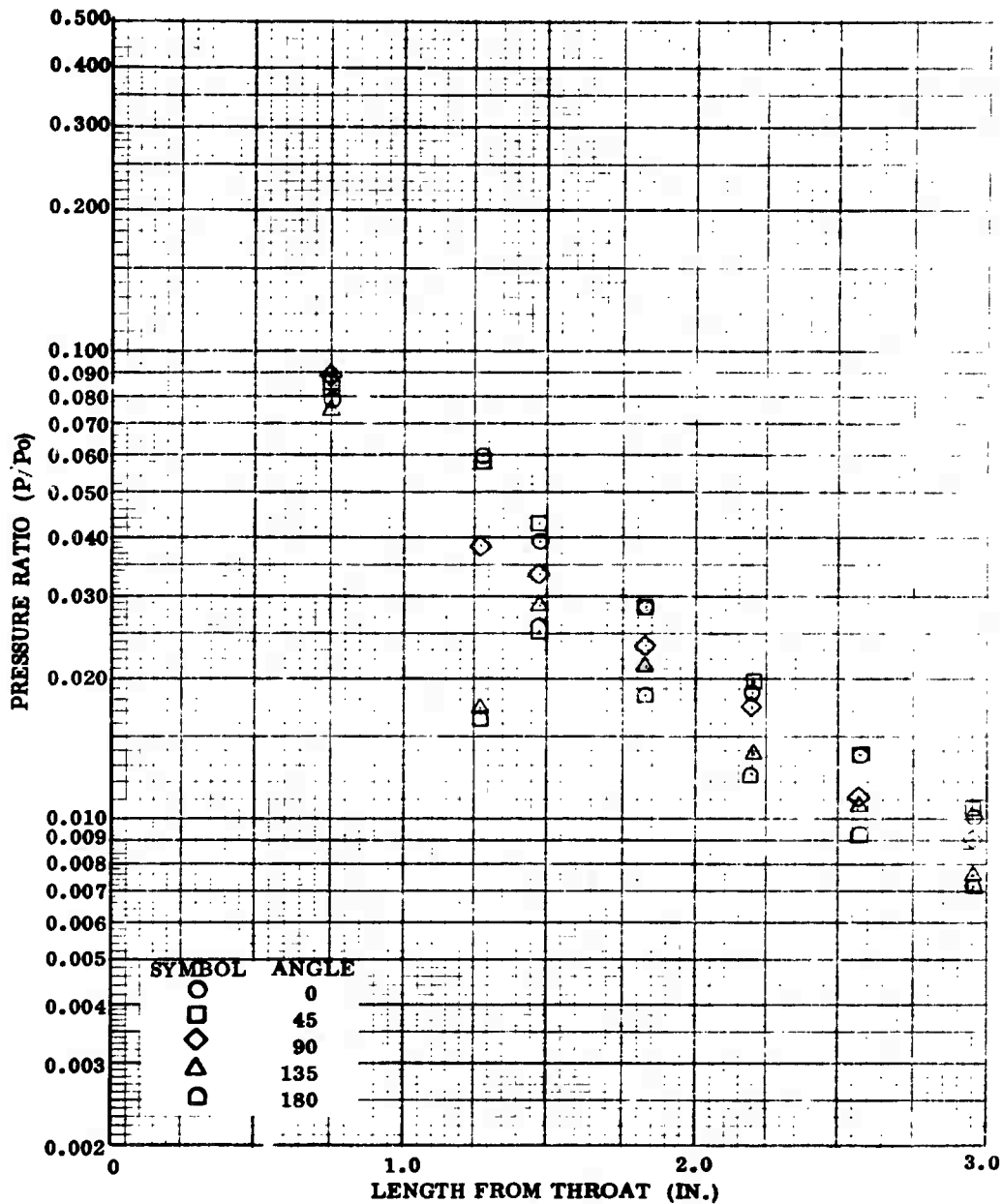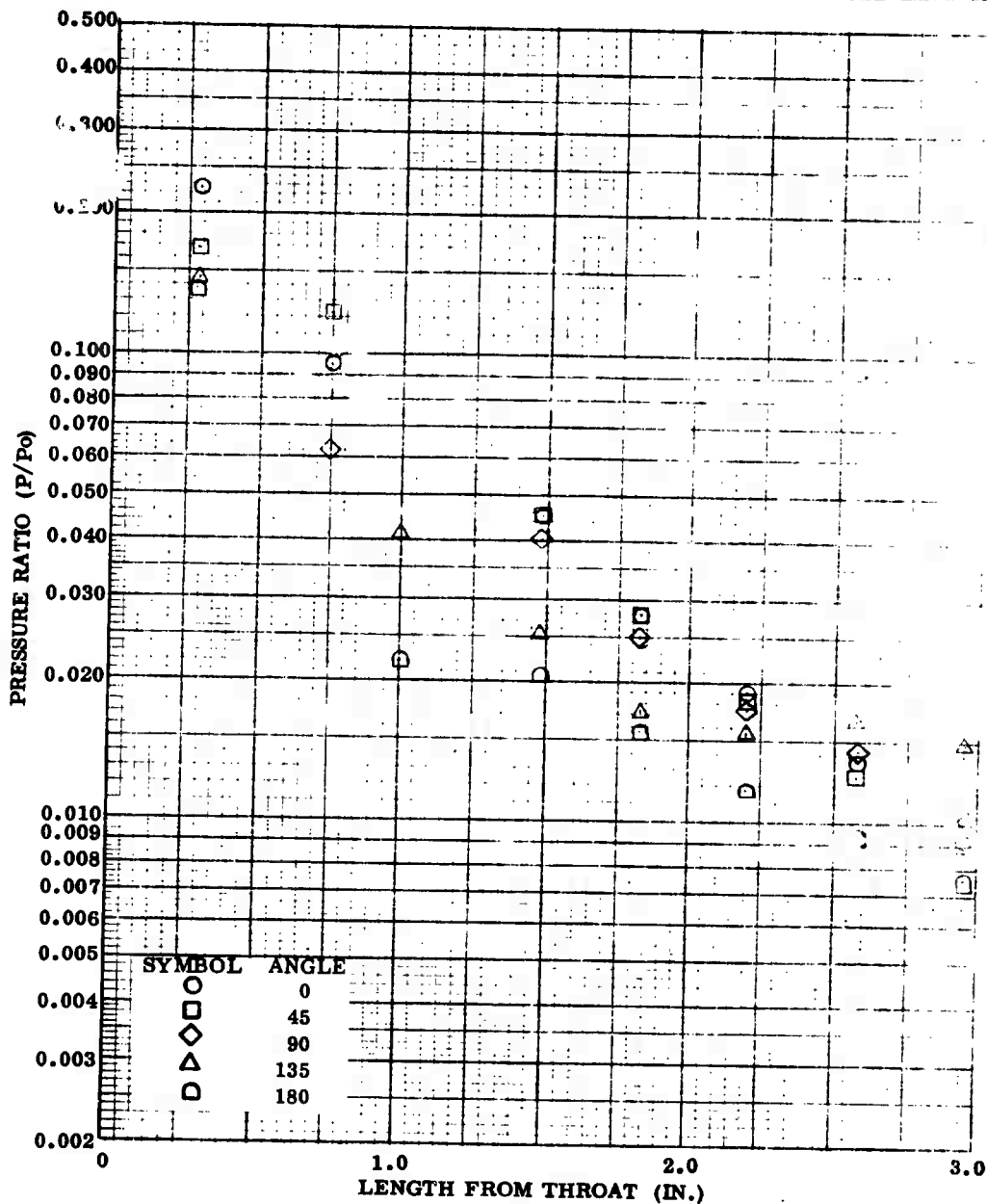Flex-X Cold Flow Run 2, Vector Angle 2.5 Degrees

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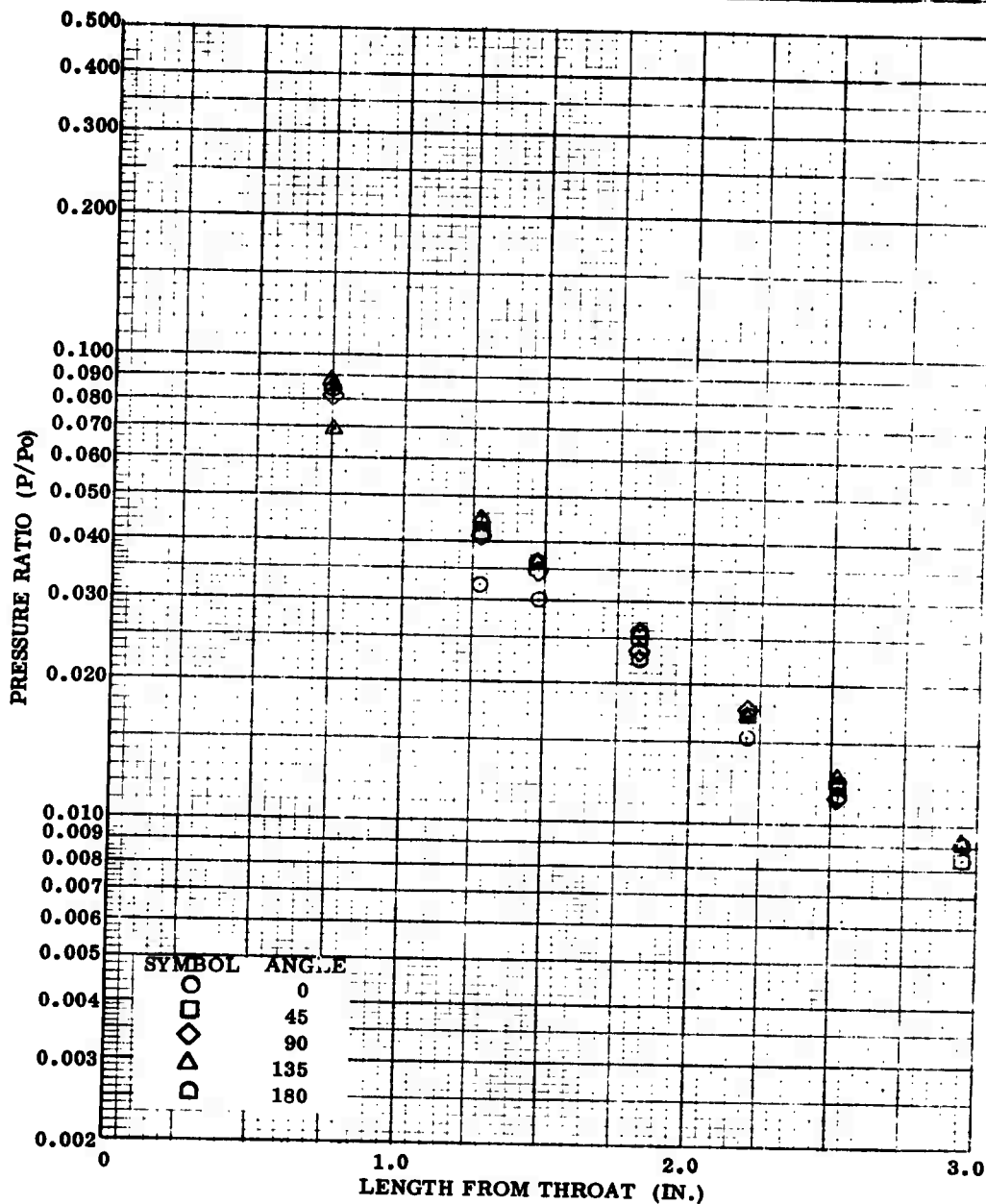Flex-X Cold Flow Run 2 , Vector Angle 0 Degrees

6

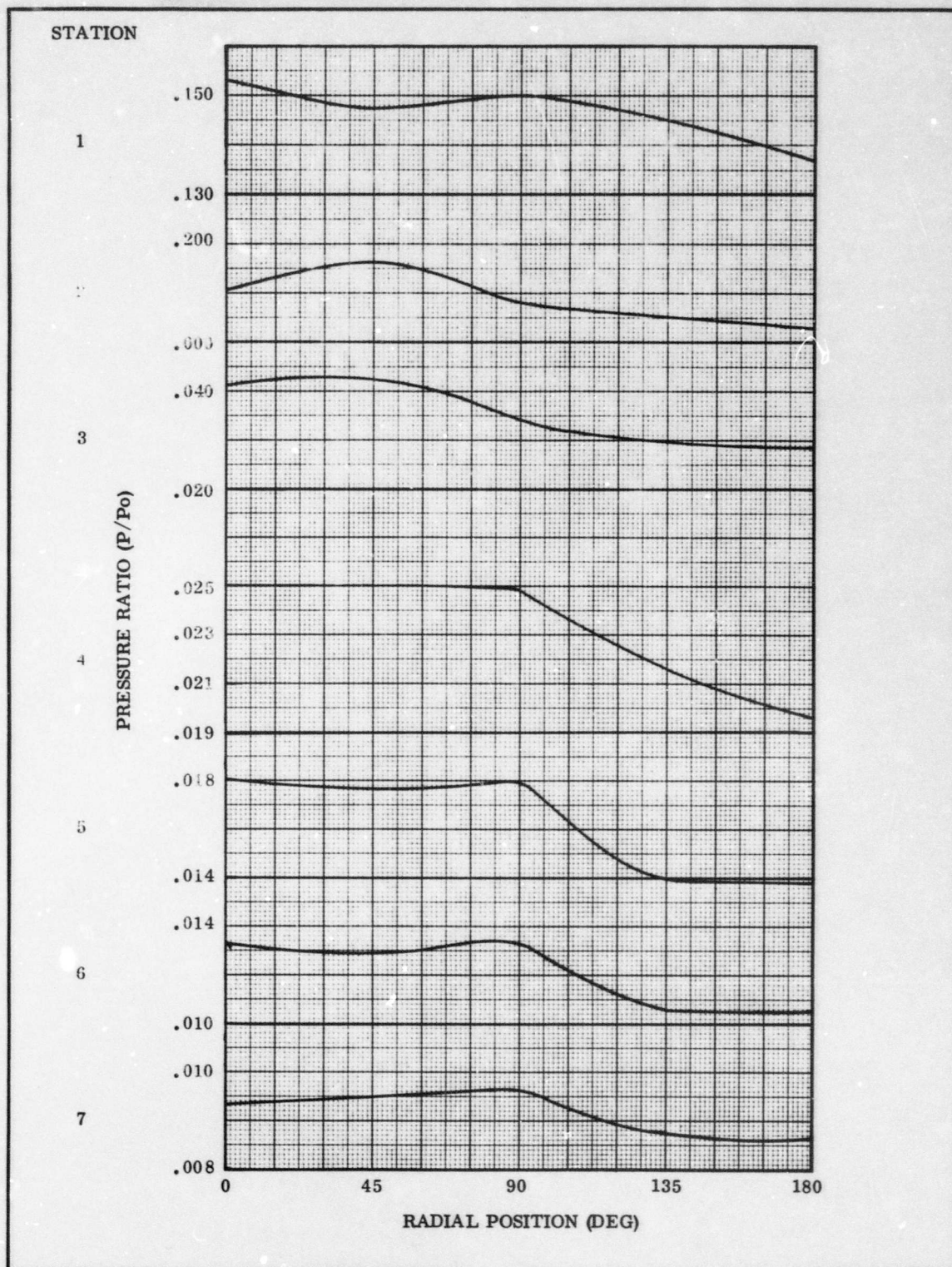Flex-X Cold Flow Run No. 2 , Vector Angle 2.5 Degrees

7

Flex-X Cold Flow Run No. 2 , Vector Angle 5 Degrees

8

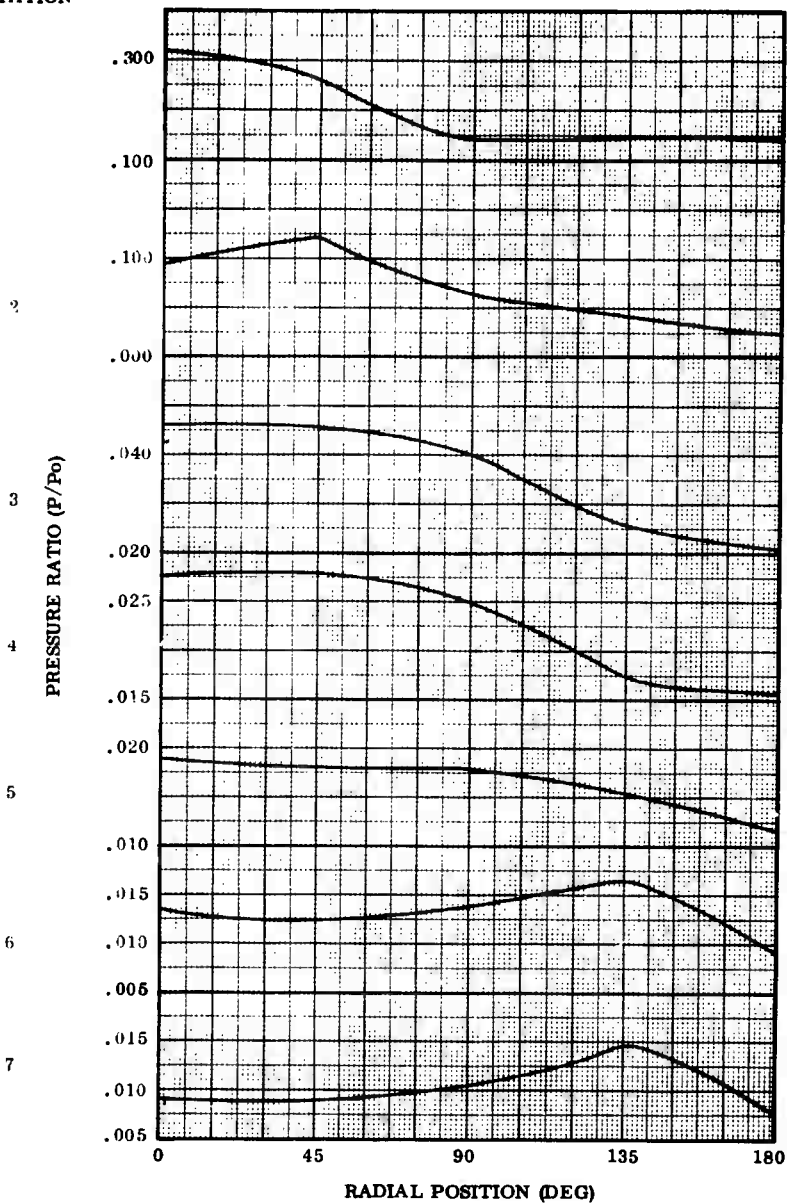**Flex-X Cold Flow Run No. 1 , Vector Angle 10 Degrees**
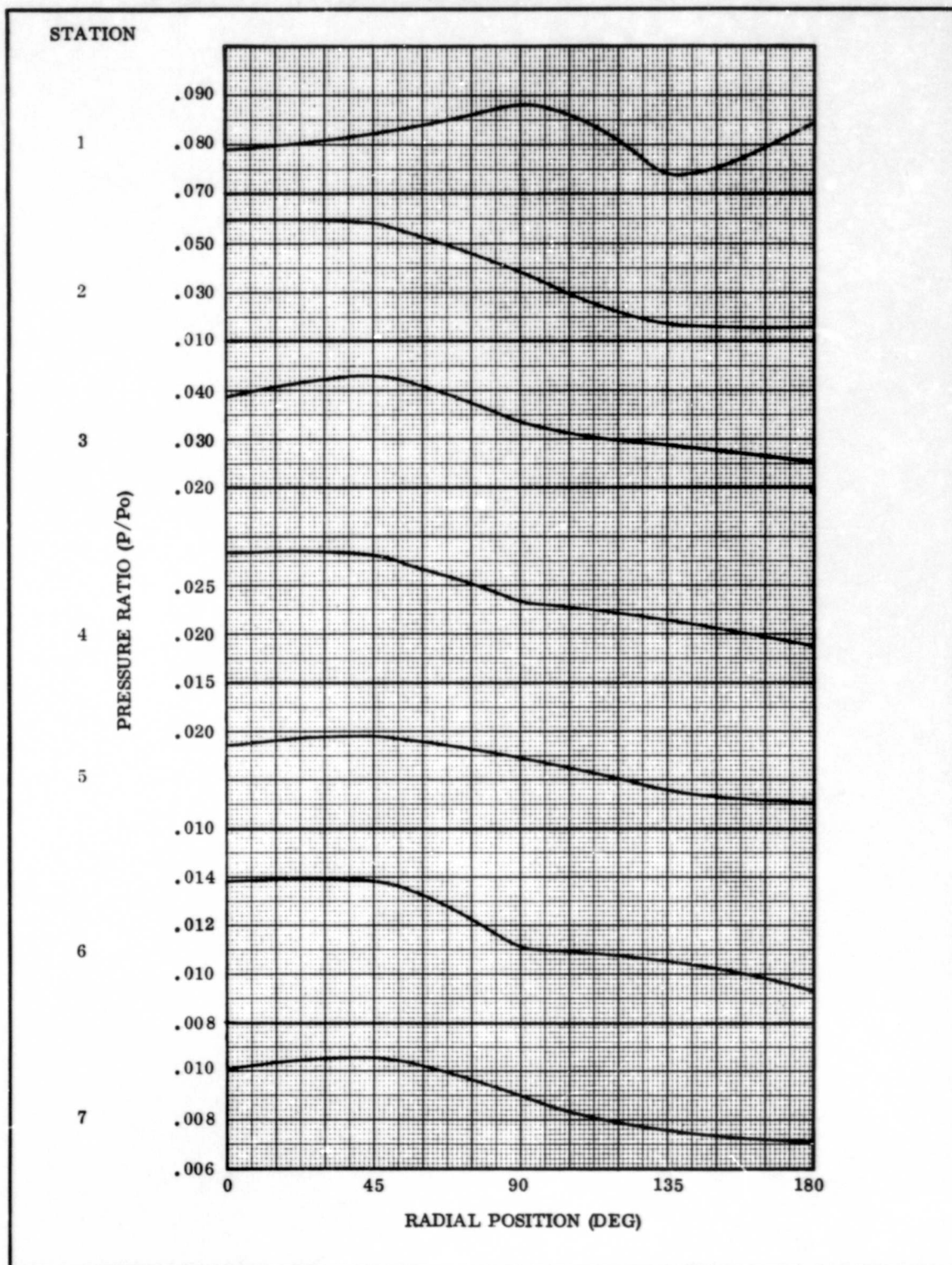
Flex-X Cold Flow Run No. 2 , Vector Angle 0 Degrees

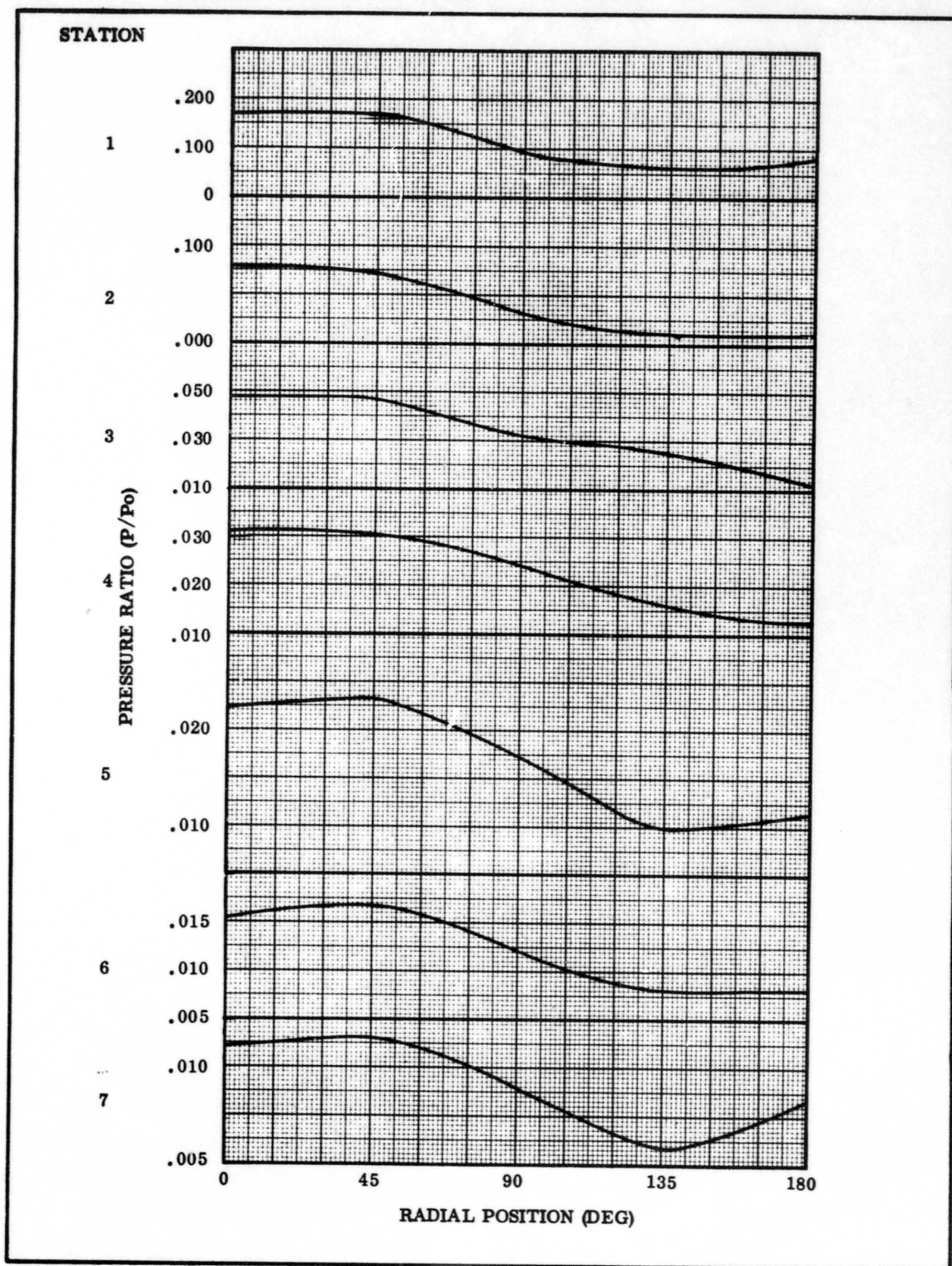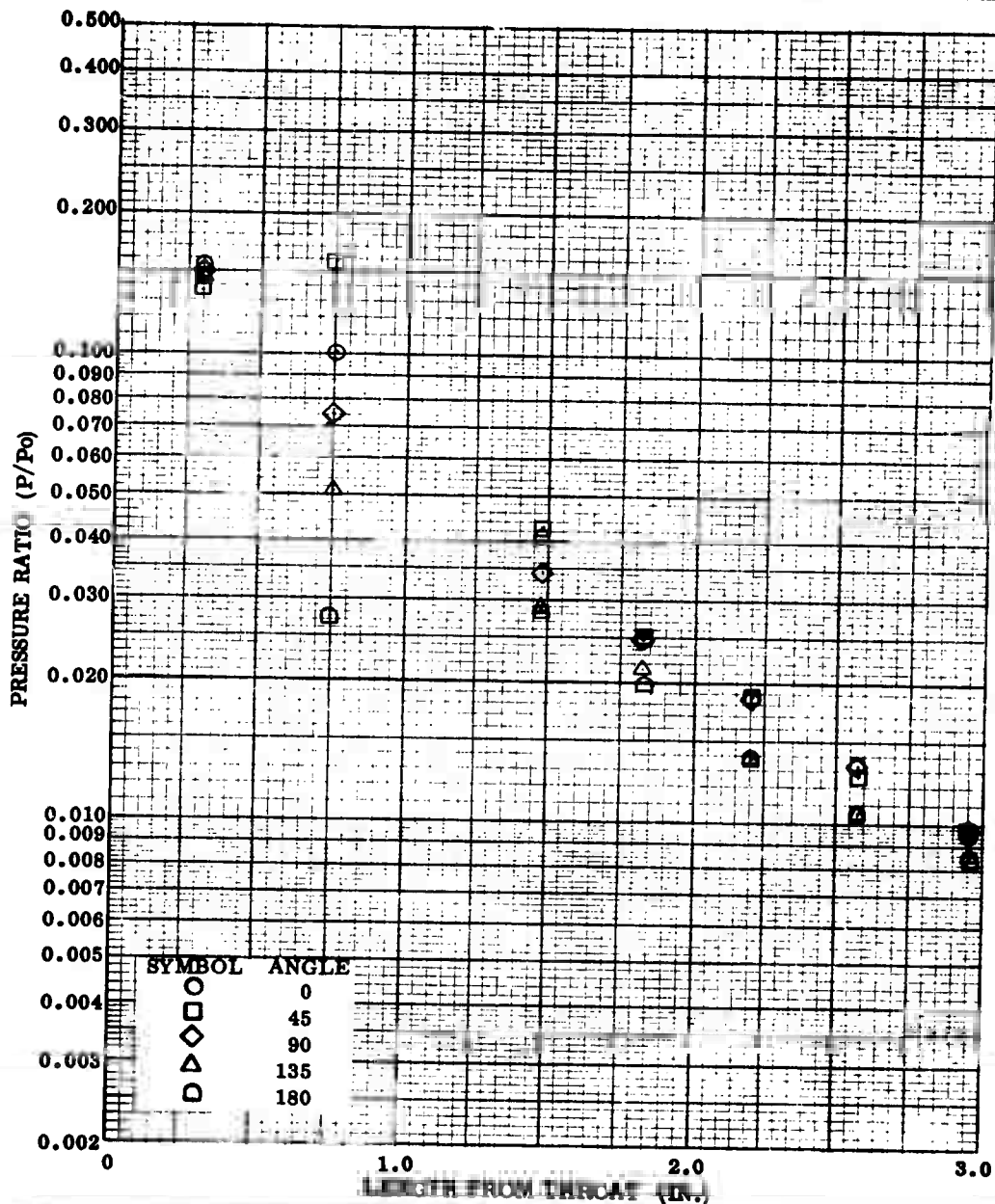Flex-X Cold Flow Run 1, Vector Angle 5 Degrees

11

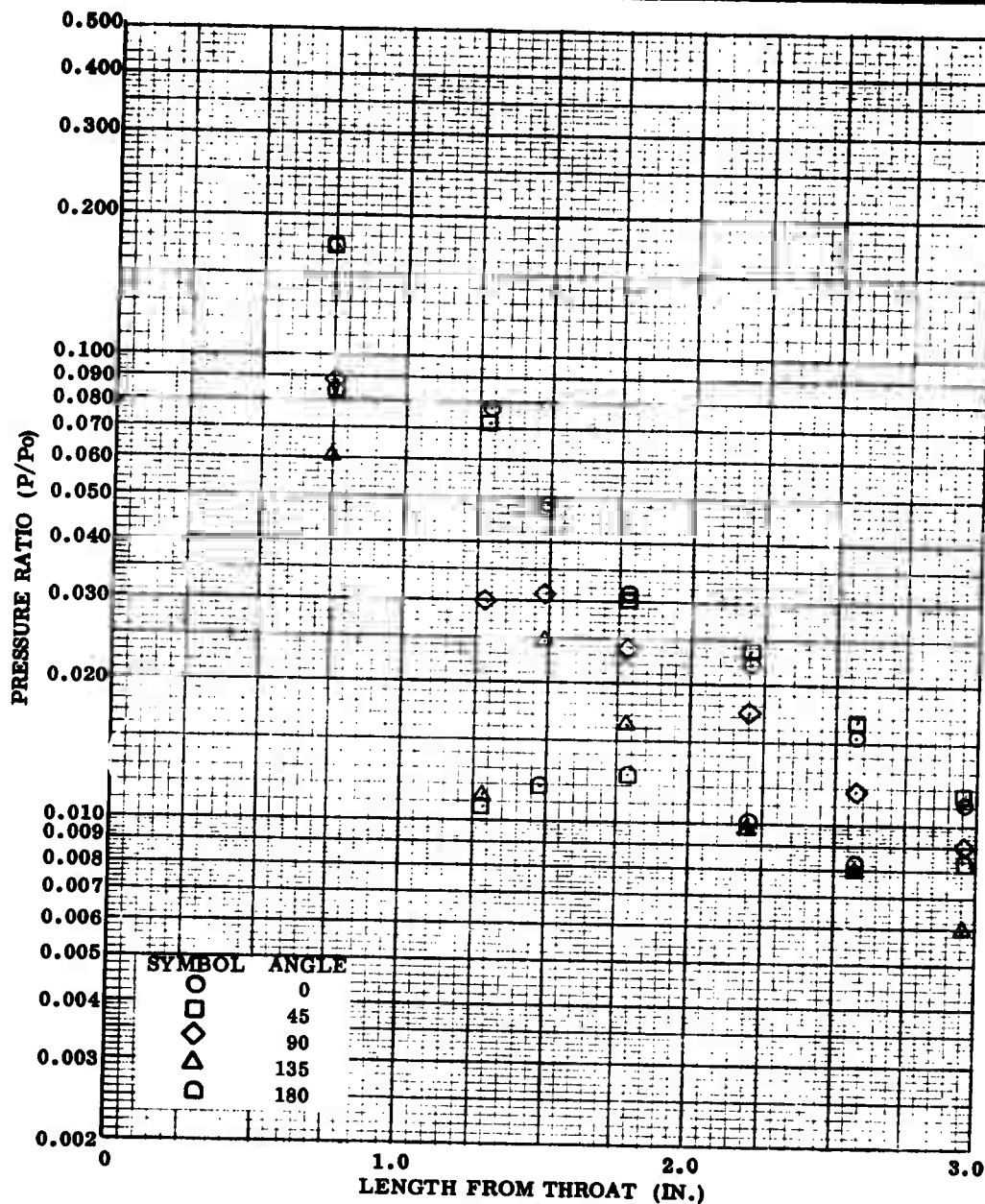Flex-X Cold Flow Run 1, Vector Angle 10 Degrees

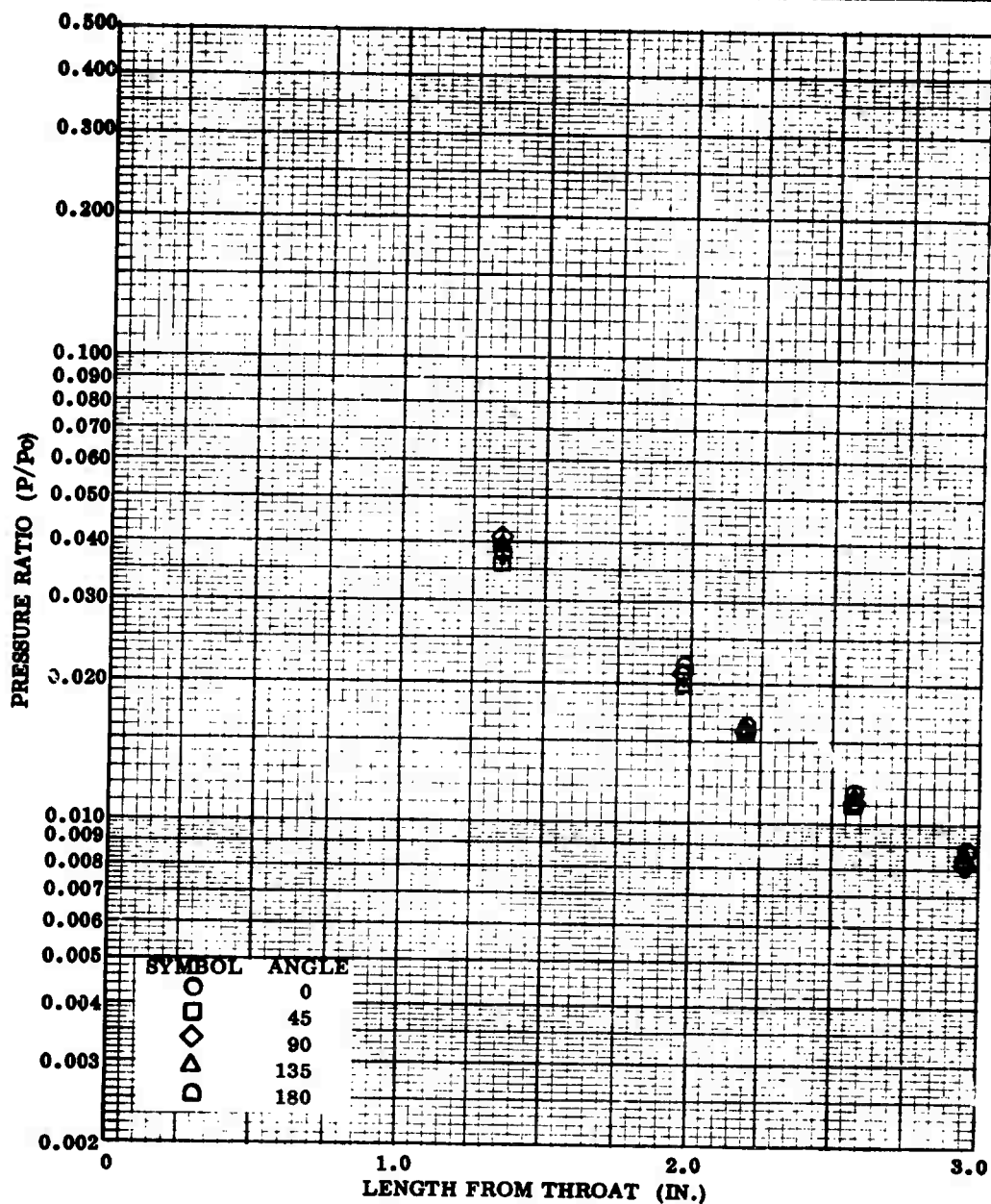Flex-X Cold Flow Run 2 , Vector Angle 5 Degrees

13

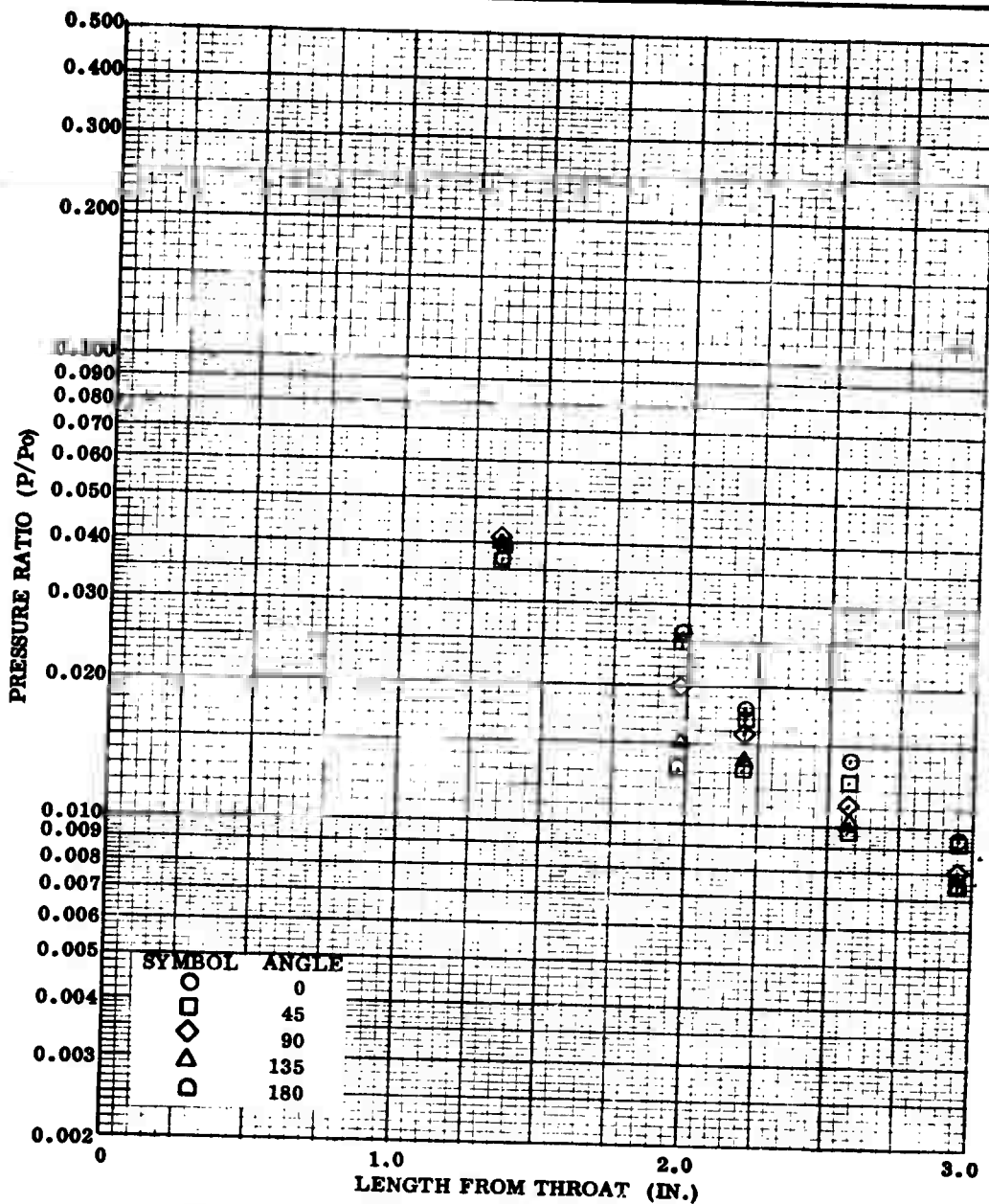Flex-X Cold Flow Run 2, Vector Angle 10 Degrees

14

Flex-X Cold Flow Run No. 1 , Vector Angle 5 Degrees

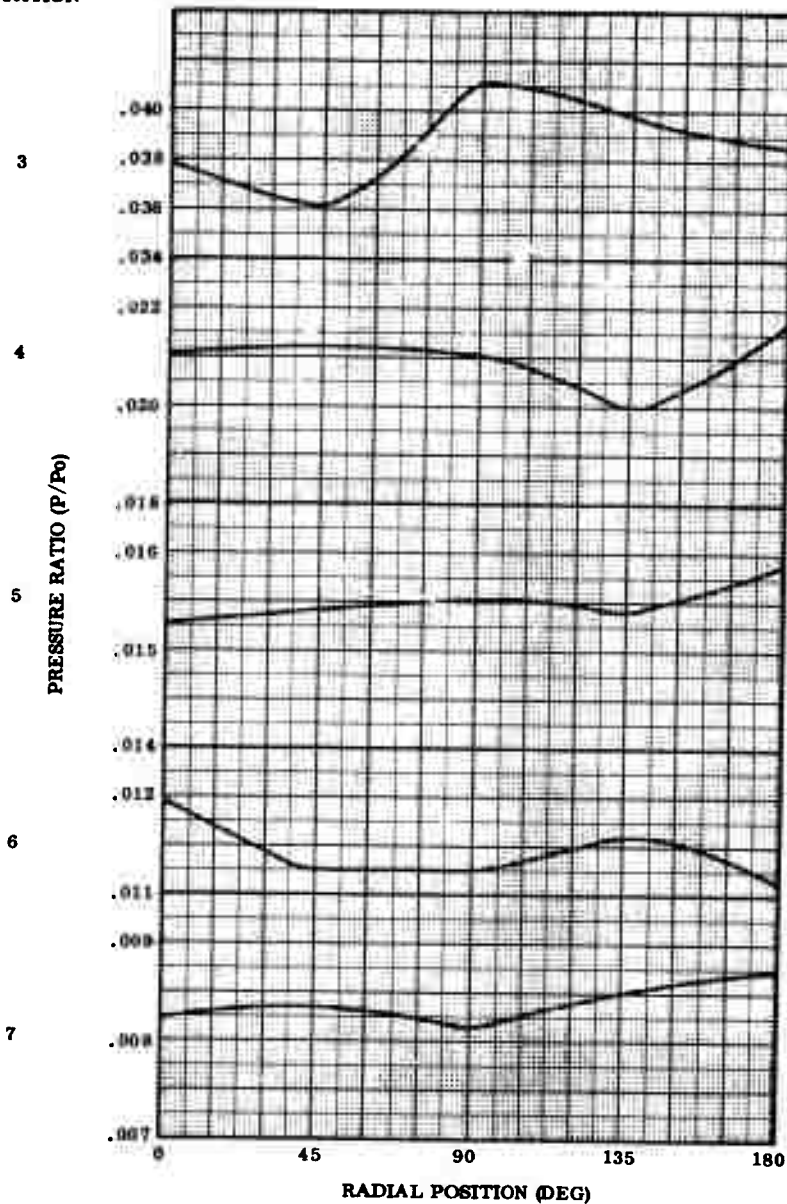Flex-X Cold Flow Run No. 2 , Vector Angle 10 Degrees

Flex-X Cold Flow Run No. 3 , Vector Angle 0 Degrees

Flex-X Cold Flow Run No. 3 , Vector Angle 2.5 Degrees

Flex-X Cold Flow Run 3, Vector Angle 0 Degrees
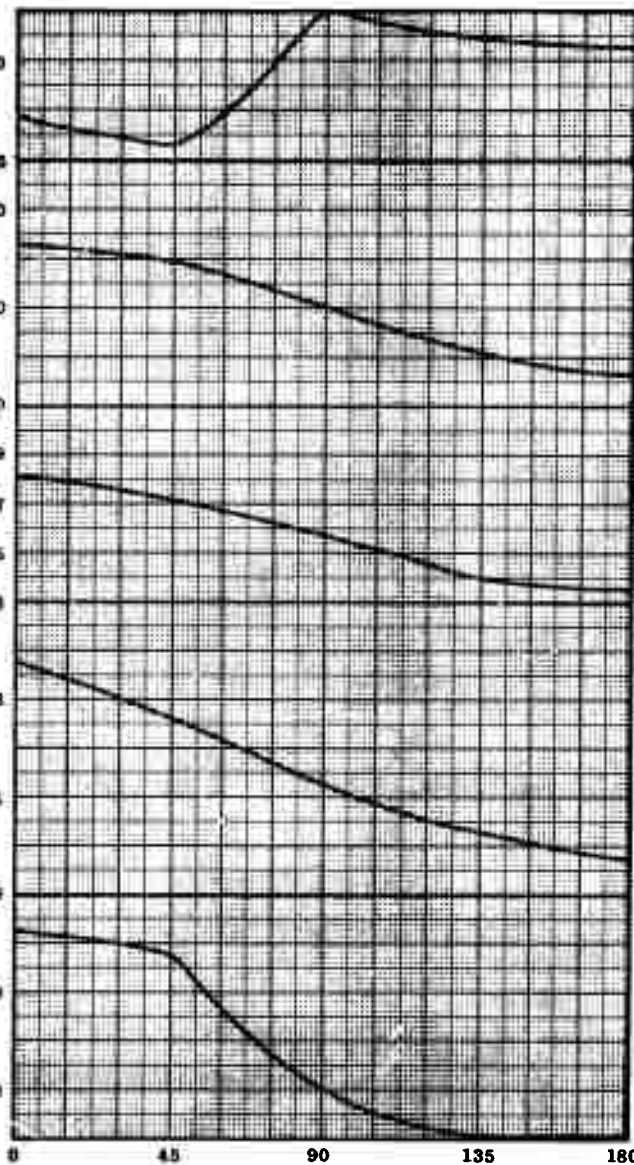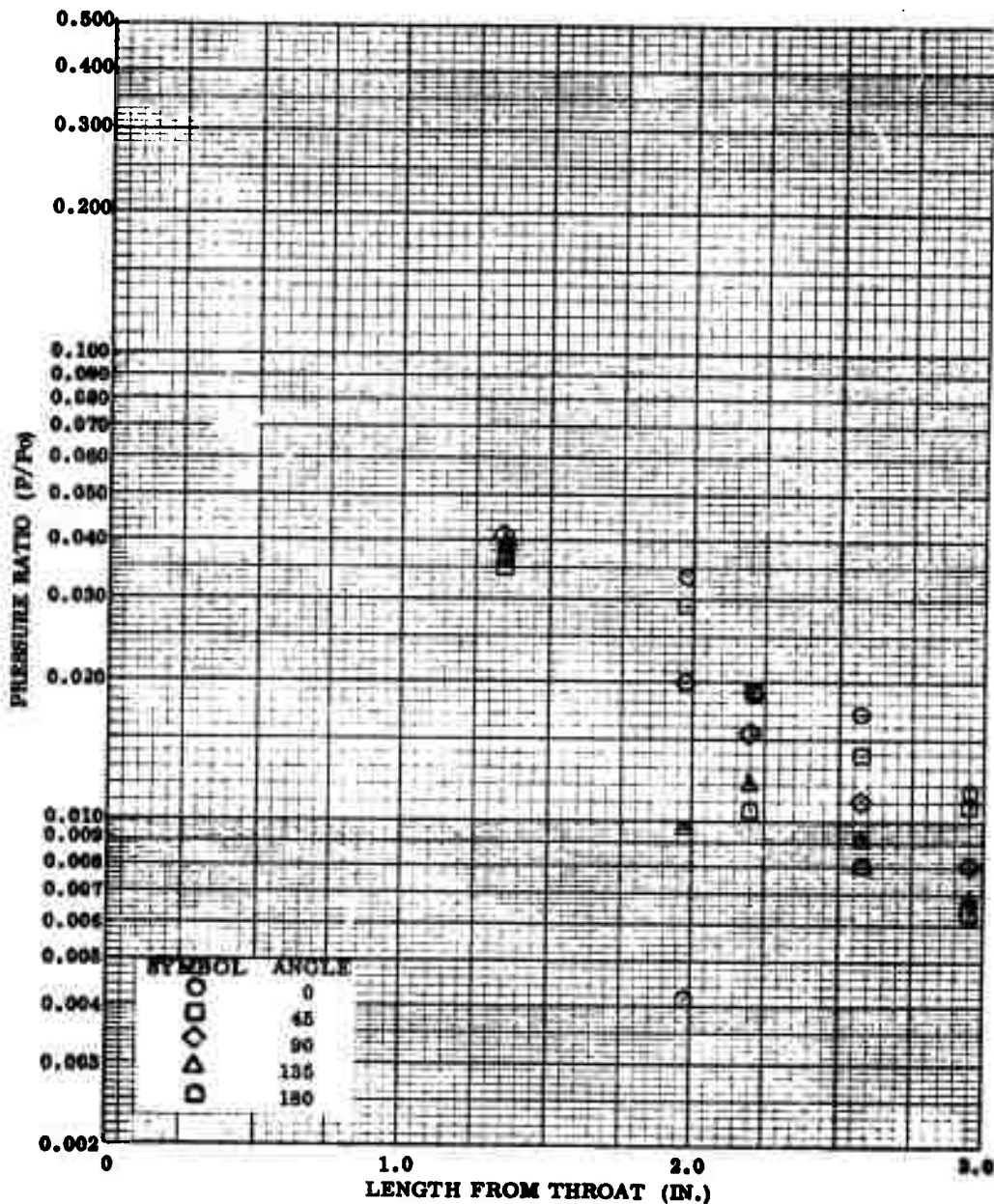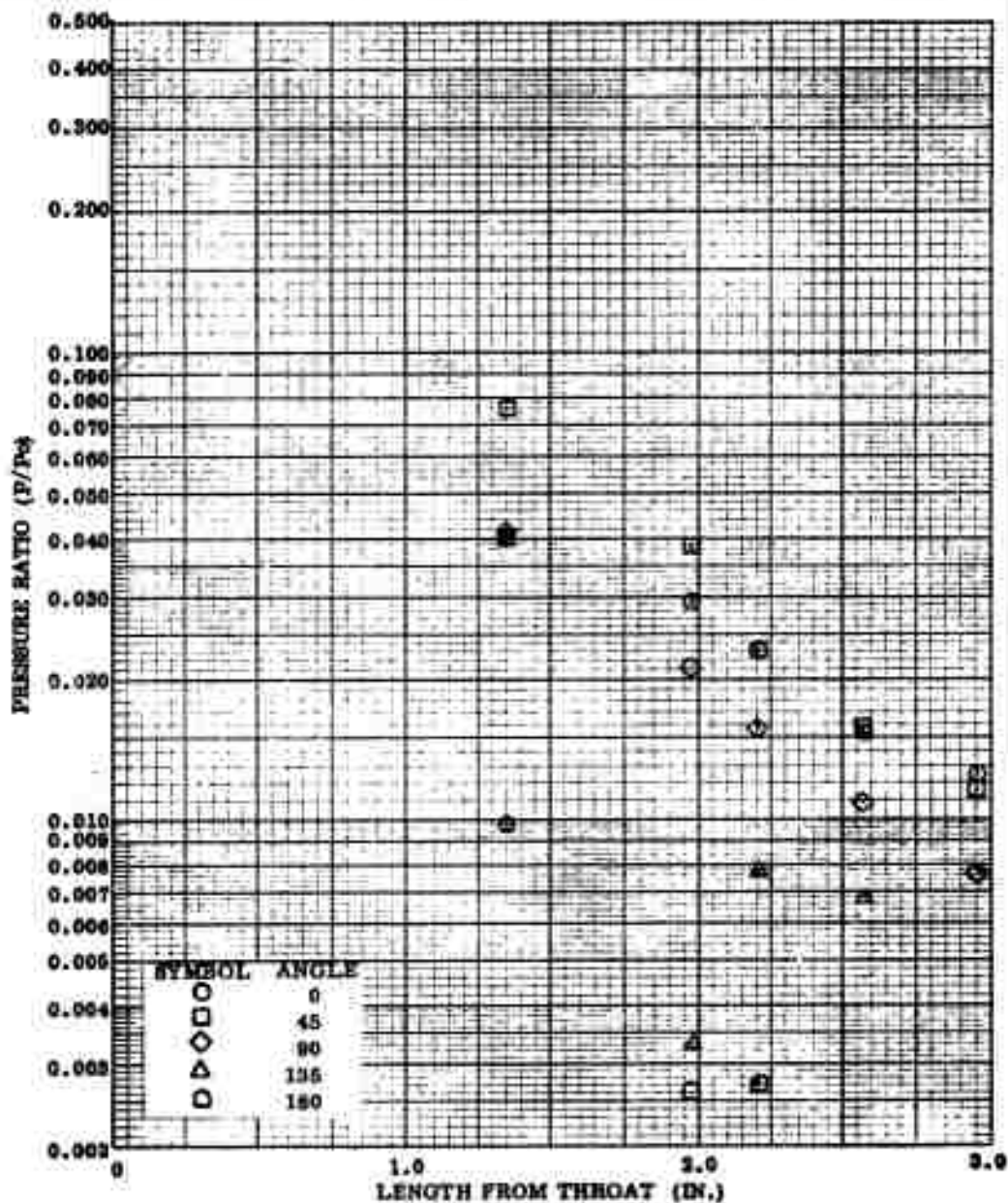
Flex-X Cold Flow Run 3 , Vector Angle 2.5 Degrees

20

Flex-X Cold Flow Run No. 3 , Vector Angle 5 Degrees
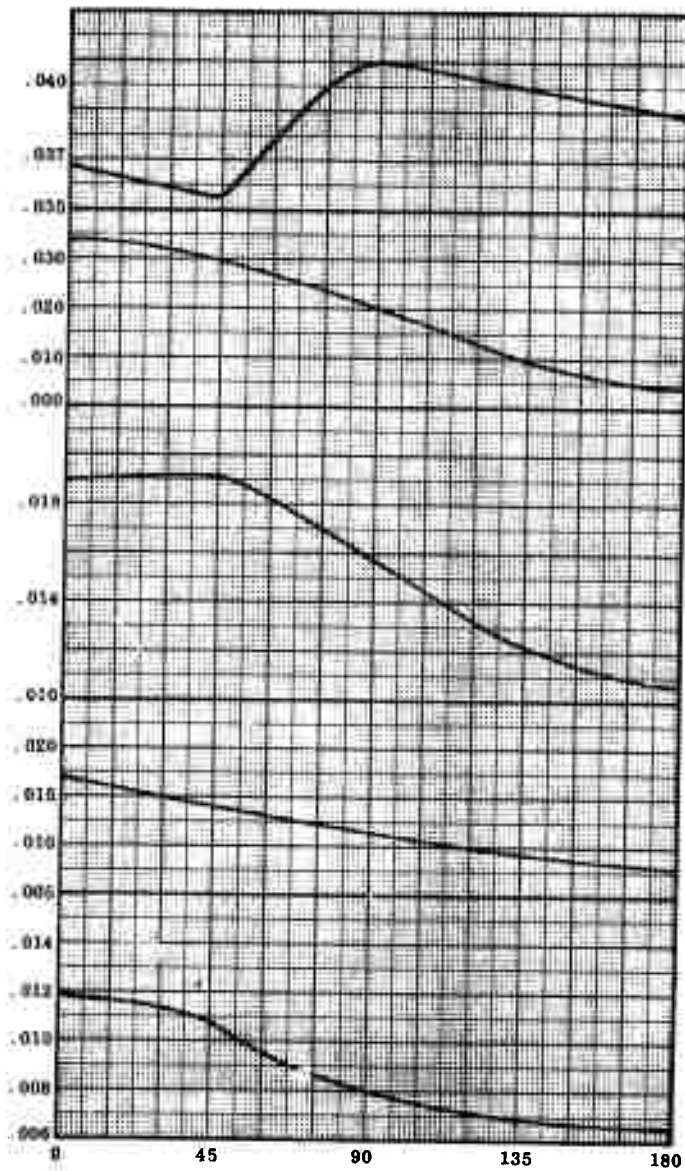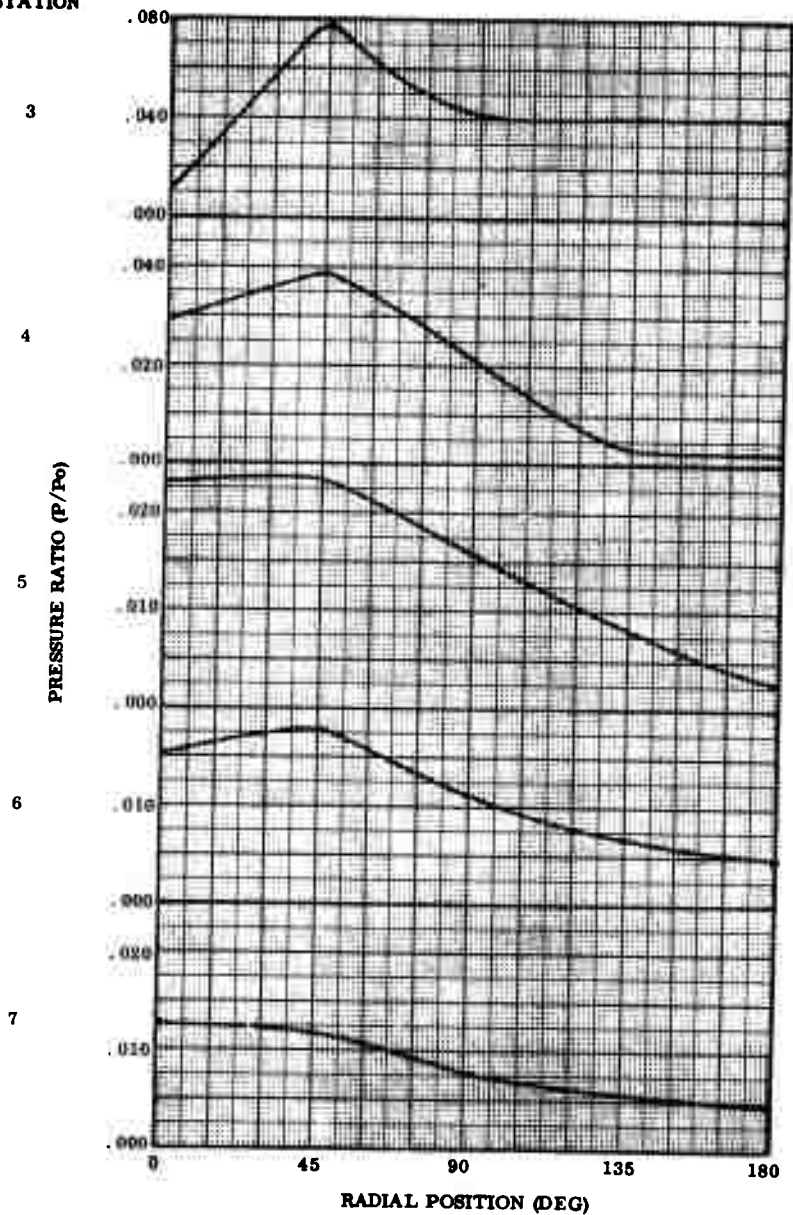
Flex-X Cold Flow Run No. 3 , Vector Angle 10 Degrees

22
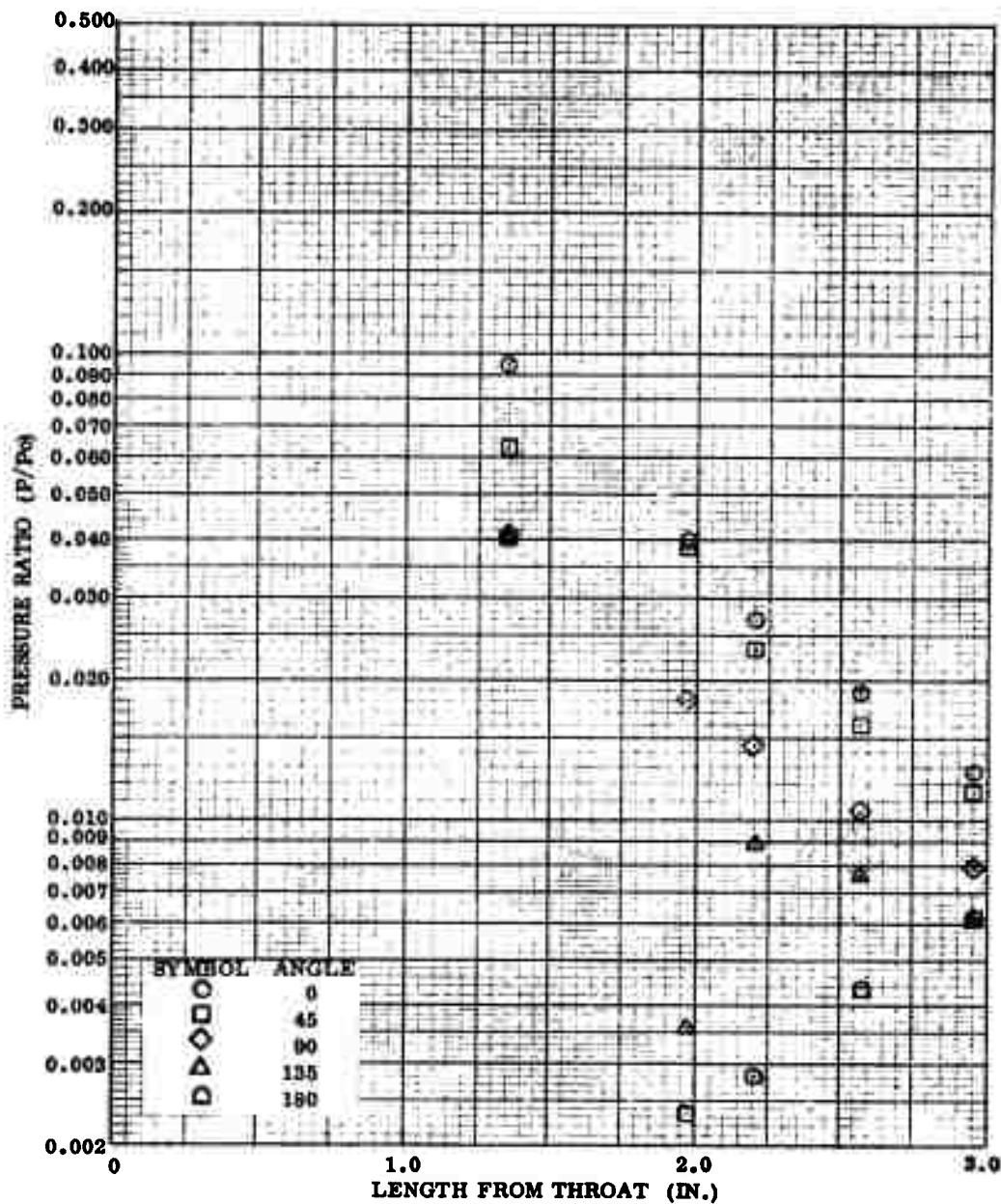
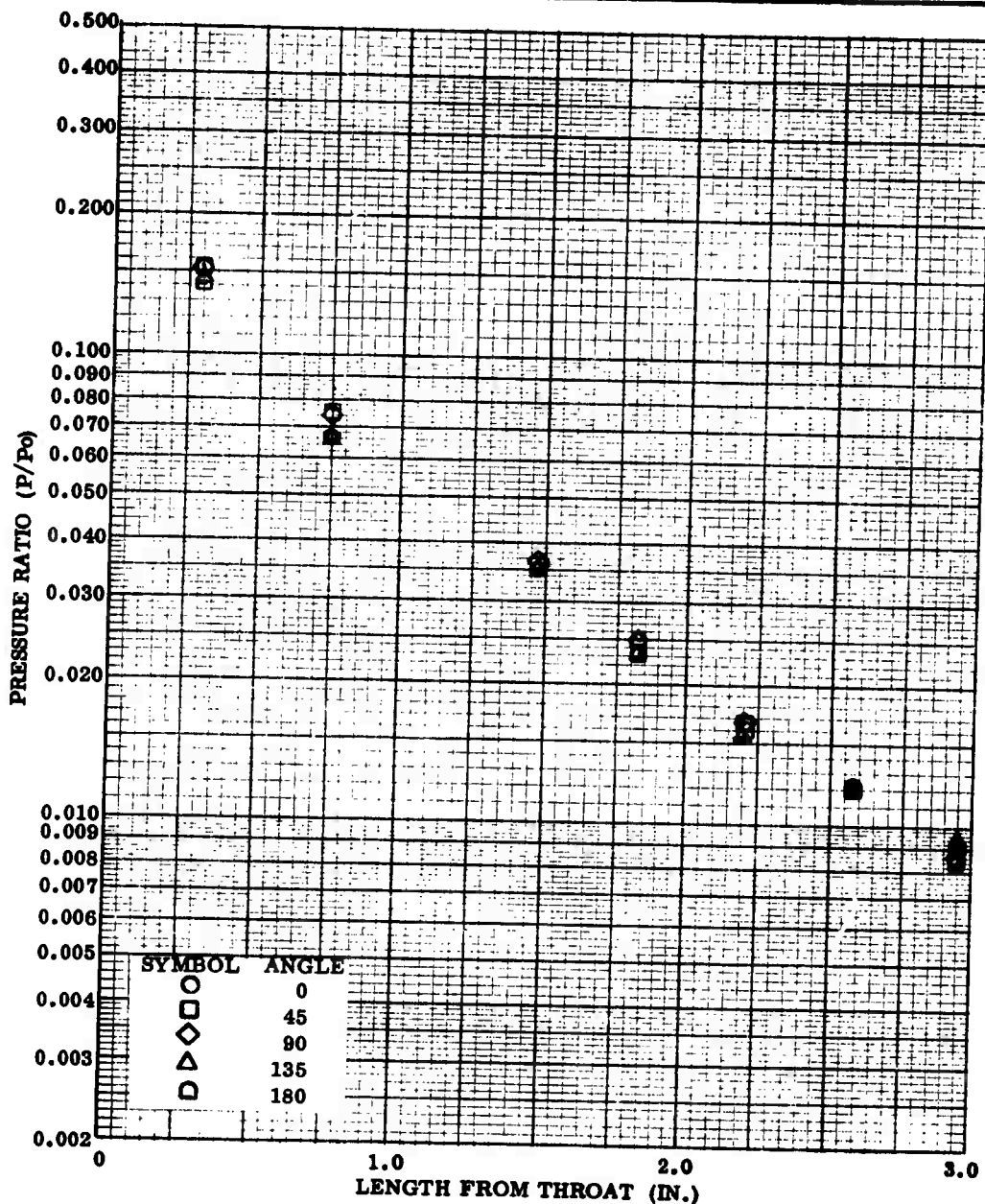Flex-X Cold Flow Run 3 , Vector Angle 5 Degrees

Flex-X Cold Flow Run 3 , Vector Angle 10 Degrees

24

Flex-X Cold Flow Run No. 3A , Vector Angle 10 Degrees

25

Flex-X Cold Flow Run No. 4 , Vector Angle 0 Degrees
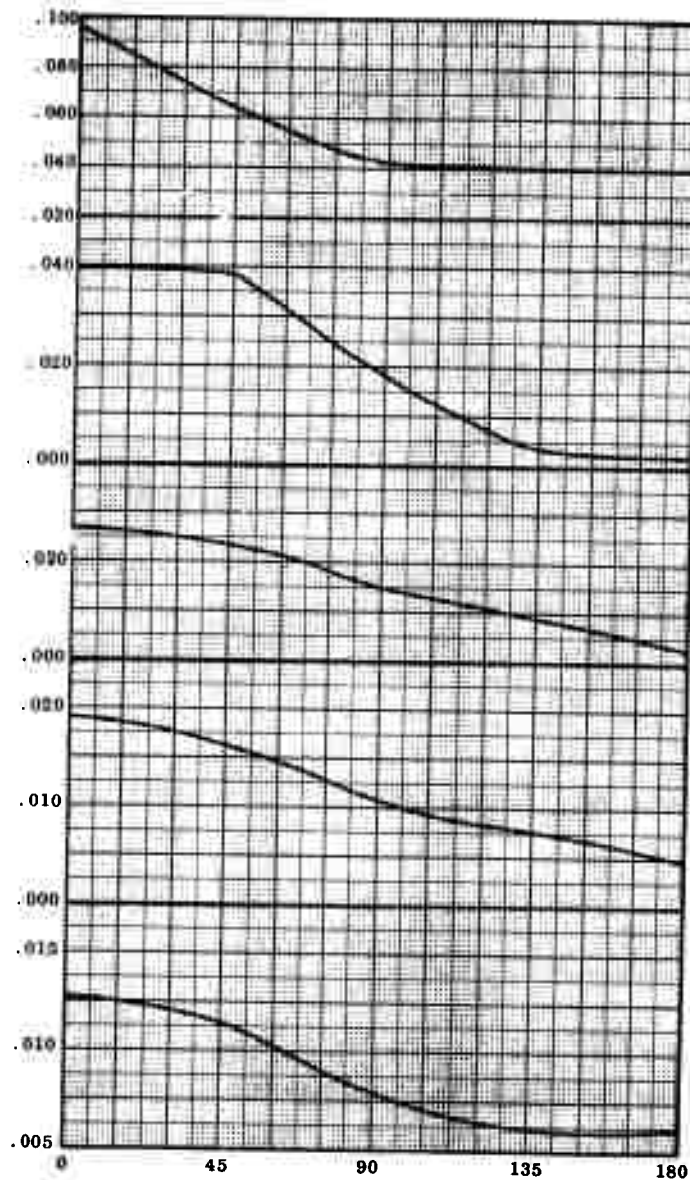
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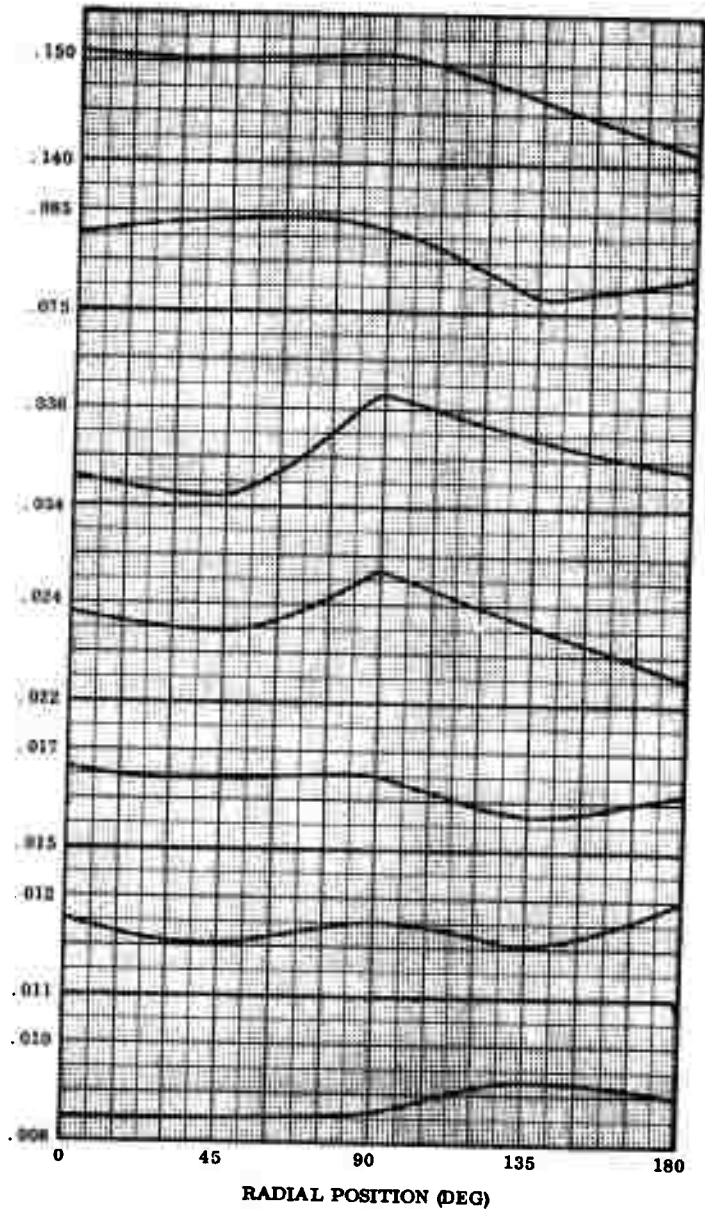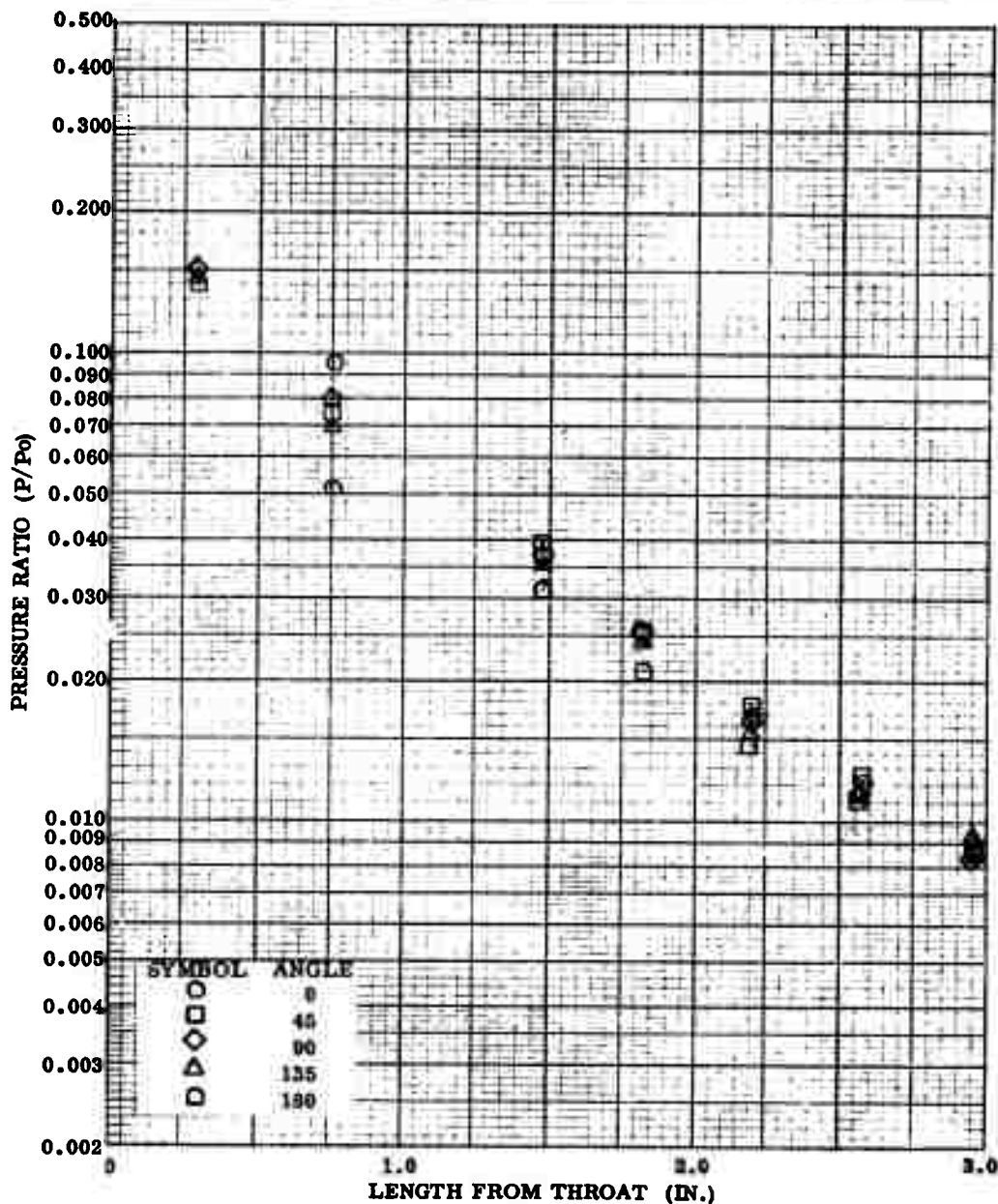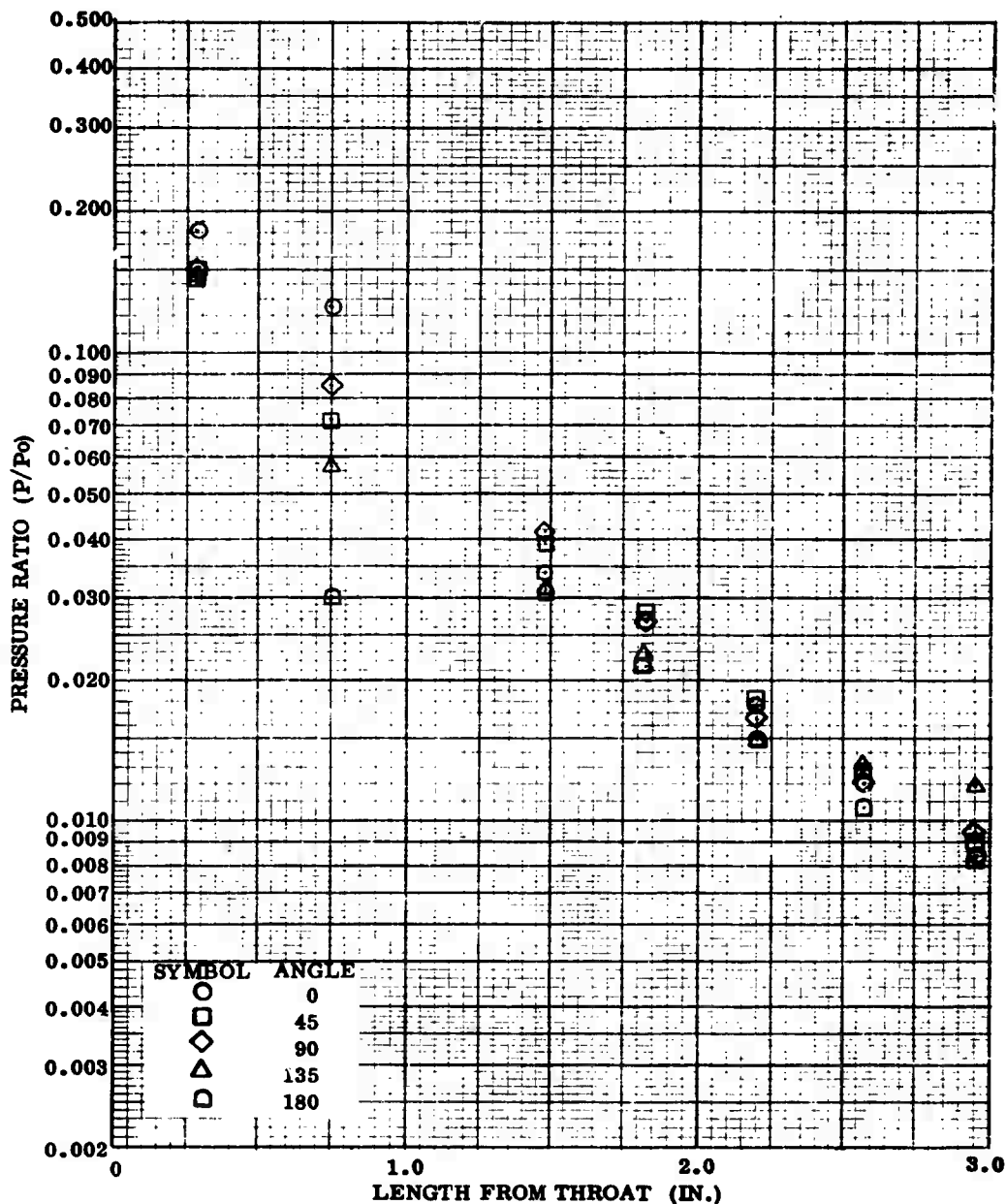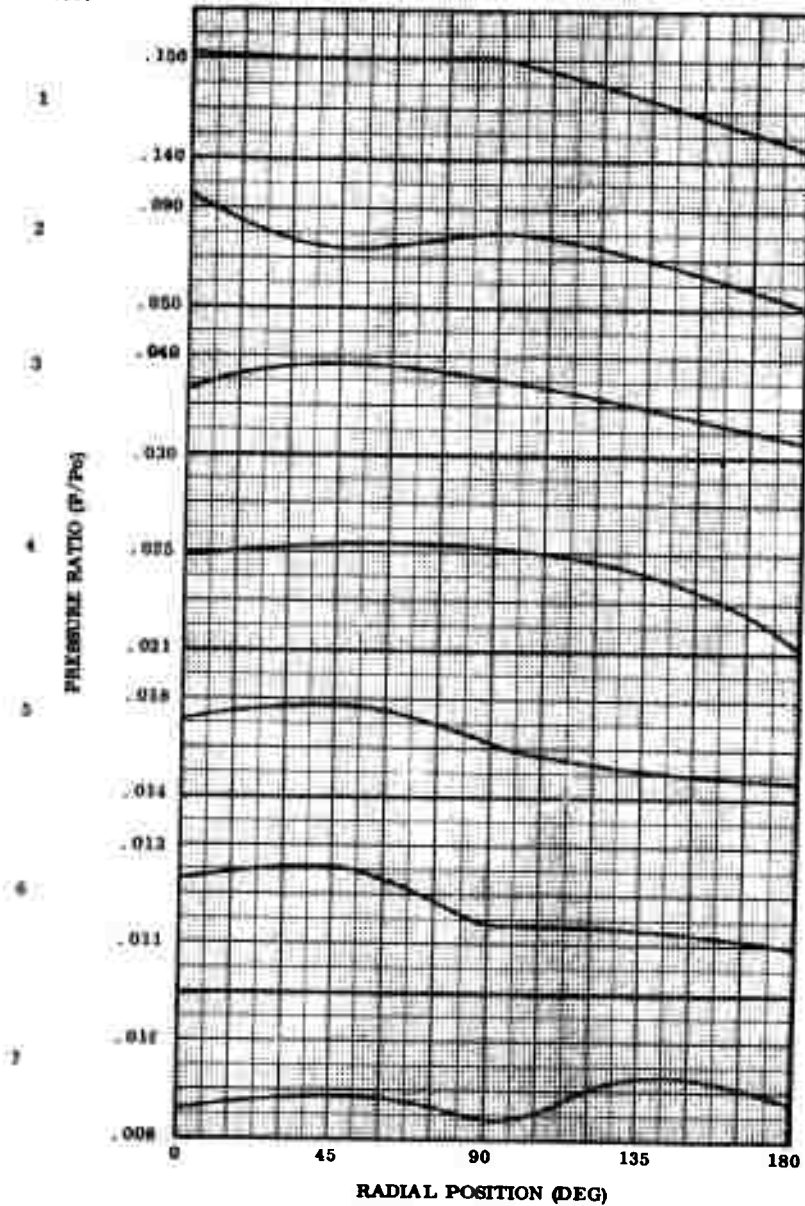
Flex-X Cold Flow Run 4 , Vector Angle 0 Degrees

Flex-X Cold Flow Run No. 4 , Vector Angle 2.5 Degrees

29

Flex-X Cold Flow Run No. 4 , Vector Angle 5 Degrees

Flex-X Cold Flow Run 4 , Vector Angle 2.5 Degrees

Flex-X Cold Flow Run 4 , Vector Angle 5 Degrees

32

Flex-X Cold Flow Run No. 4 , Vector Angle 10 Degrees

Flex-X Cold Flow Run 5 , Vector Angle 0 Degrees

Flex-X Cold Flow Run 4 , Vector Angle 10 Degrees

Flex-X Cold Flow Run No. 5 , Vector Angle 0 Degrees
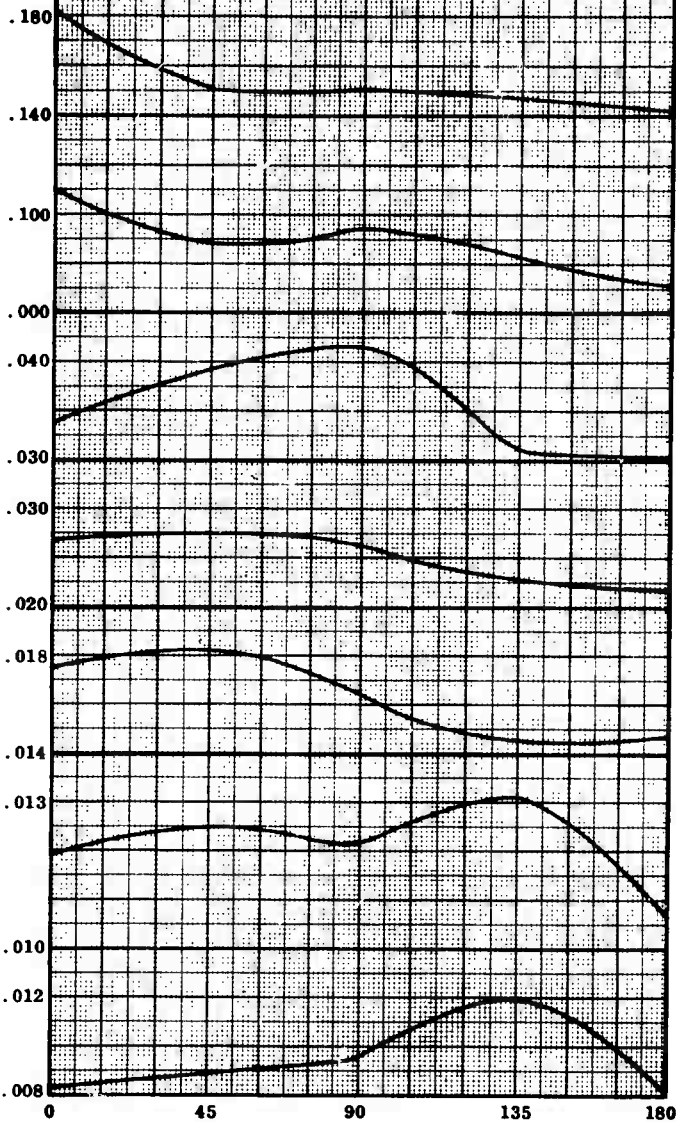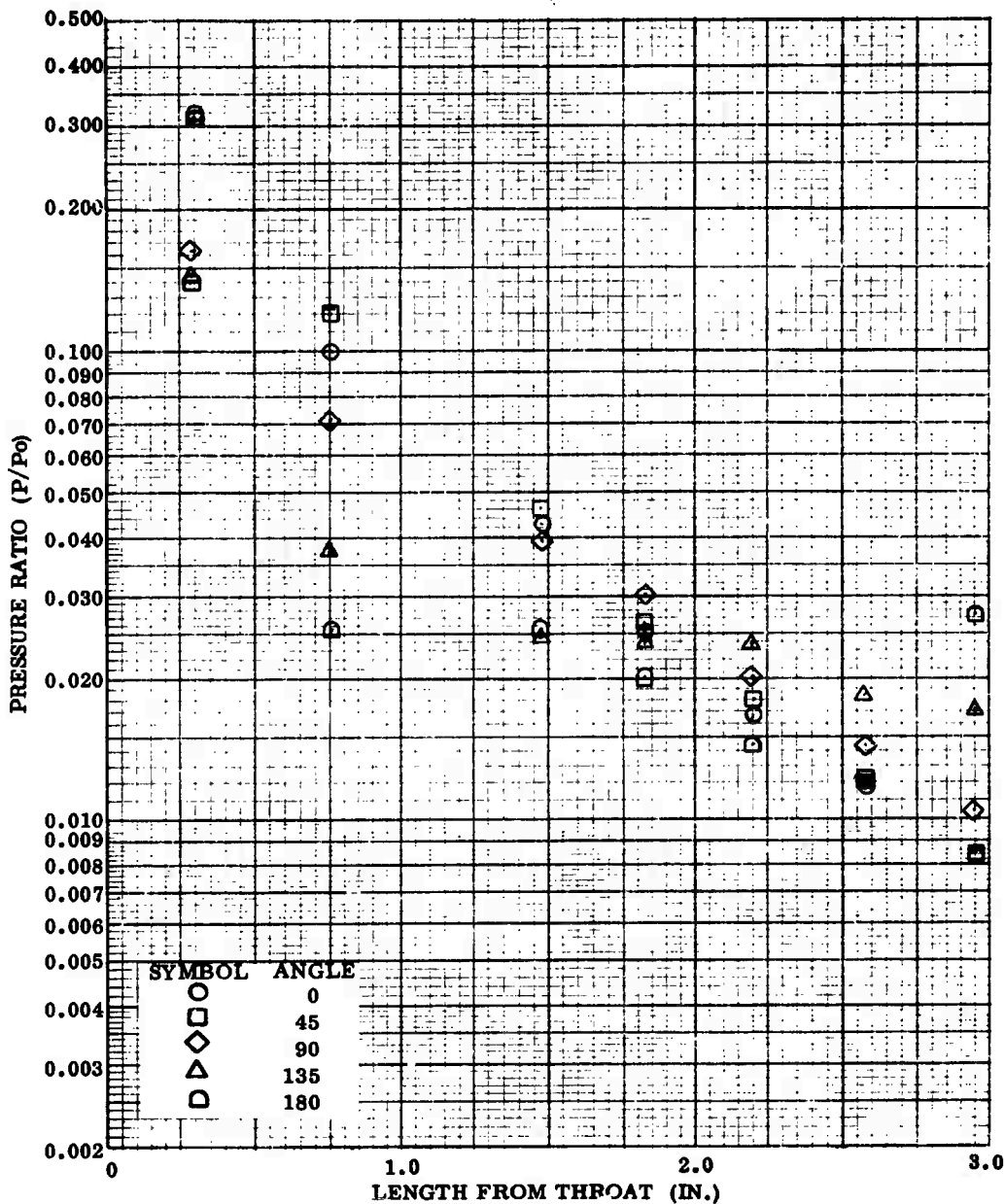
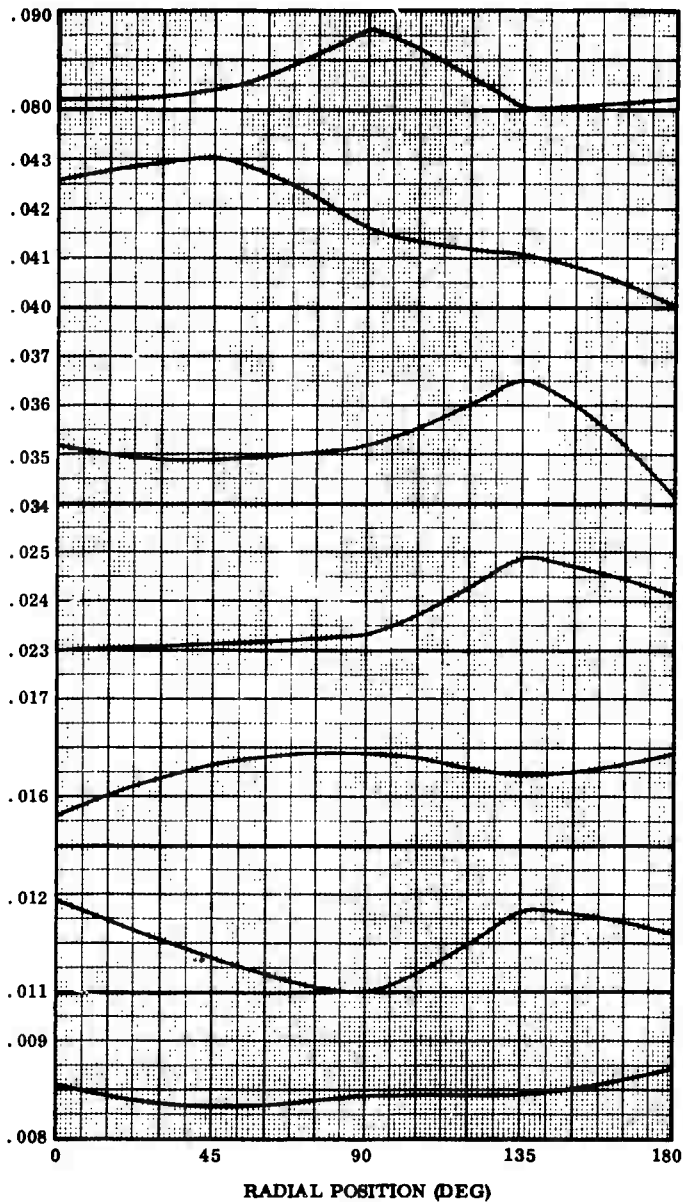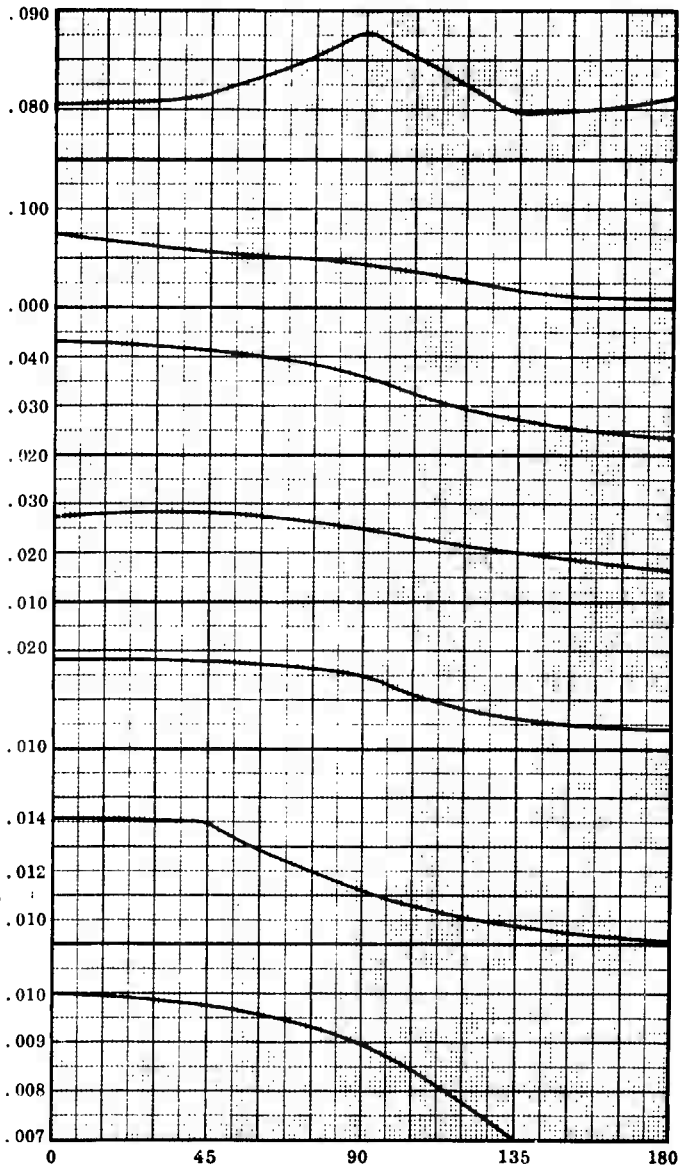Flex-X Cold Flow Run 5 , Vector Angle 5 Degrees

37

Flex-X Cold Flow Run 5 , Vector Angle 2.5 Degrees

Flex-X Cold Flow Run No. 5 , Vector Angle 2.5 Degrees

39

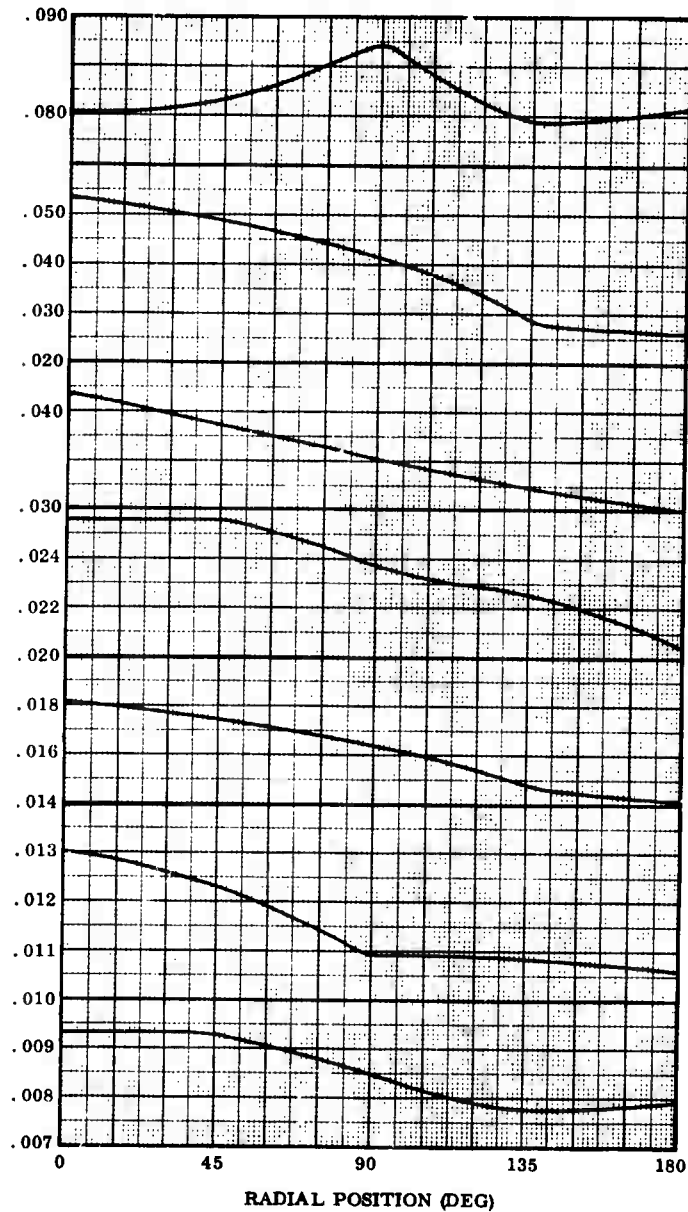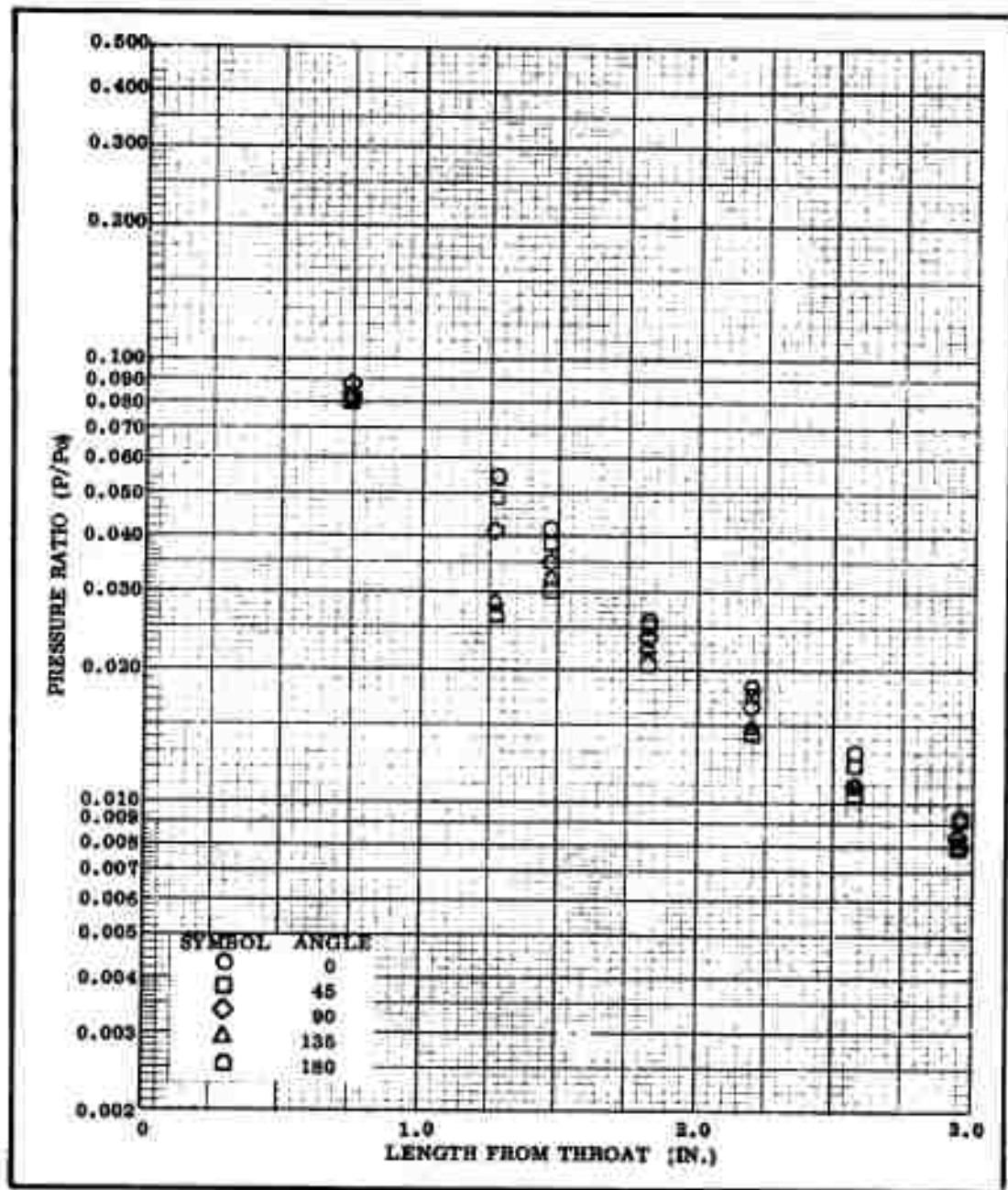Flex-X Cold Flow Run No. 5 , Vector Angle 5 Degrees

Flex-X Cold Flow Run 5 , Vector Angle 10 Degrees

41
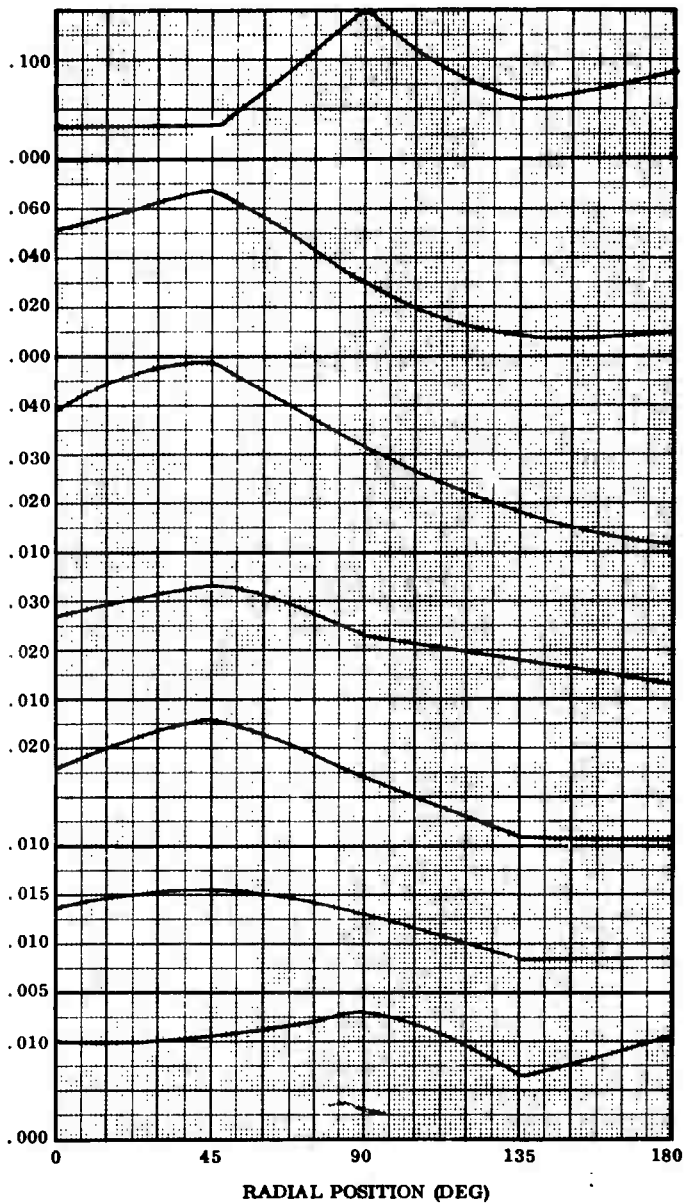
Flex-X Cold Flow Run 5C, Vector Angle 10 Degrees

42

Flex-X Cold Flow Run No. 5C , Vector Angle 10 Degrees

Flex-X Cold Flow Run No. 5 , Vector Angle 10 Degrees
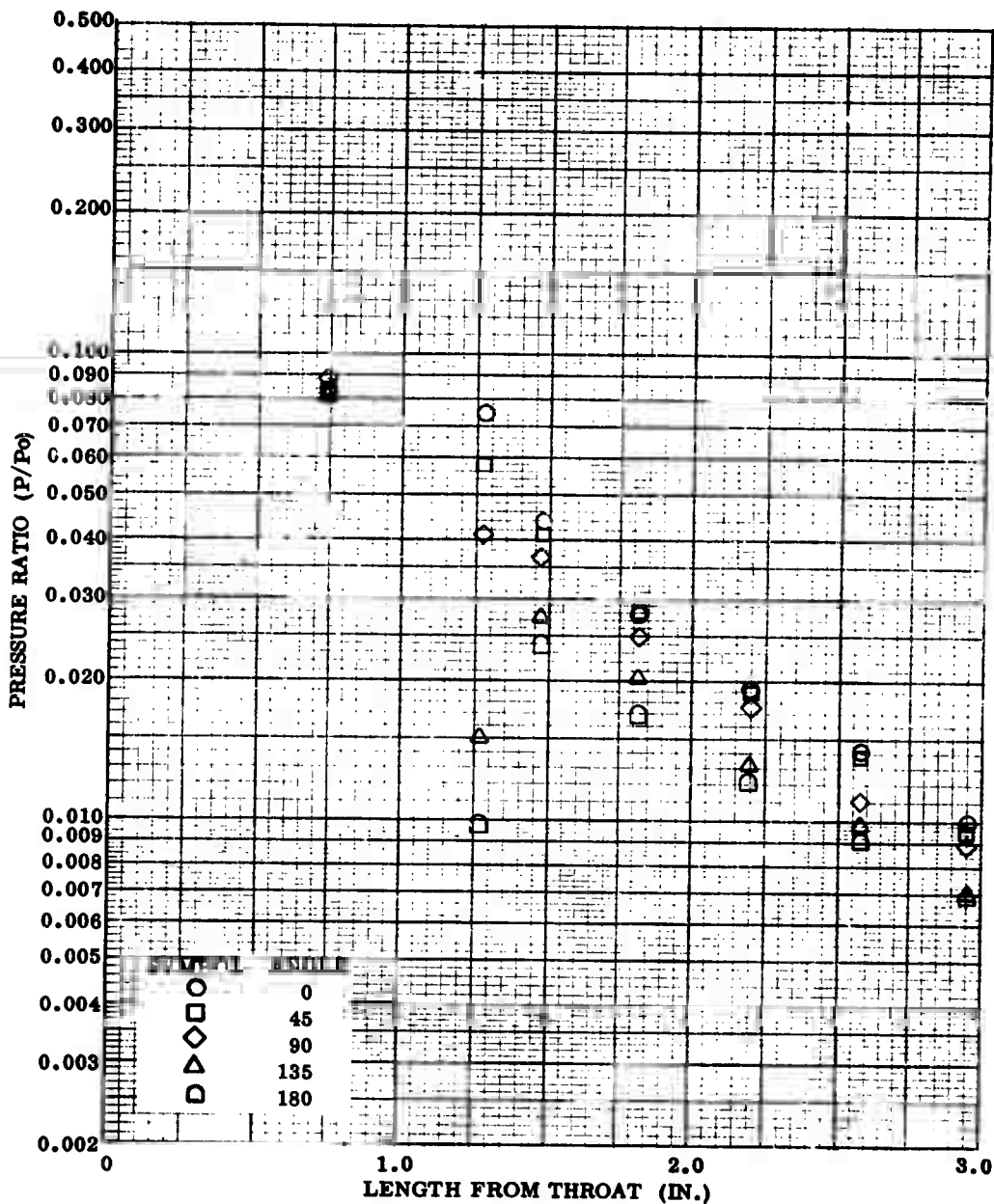
Flex-X Cold Flow Run 6 , Vector Angle 0 Degrees

Flex-X Cold Flow Run No. 6 , Vector Angle 2.5 Degrees
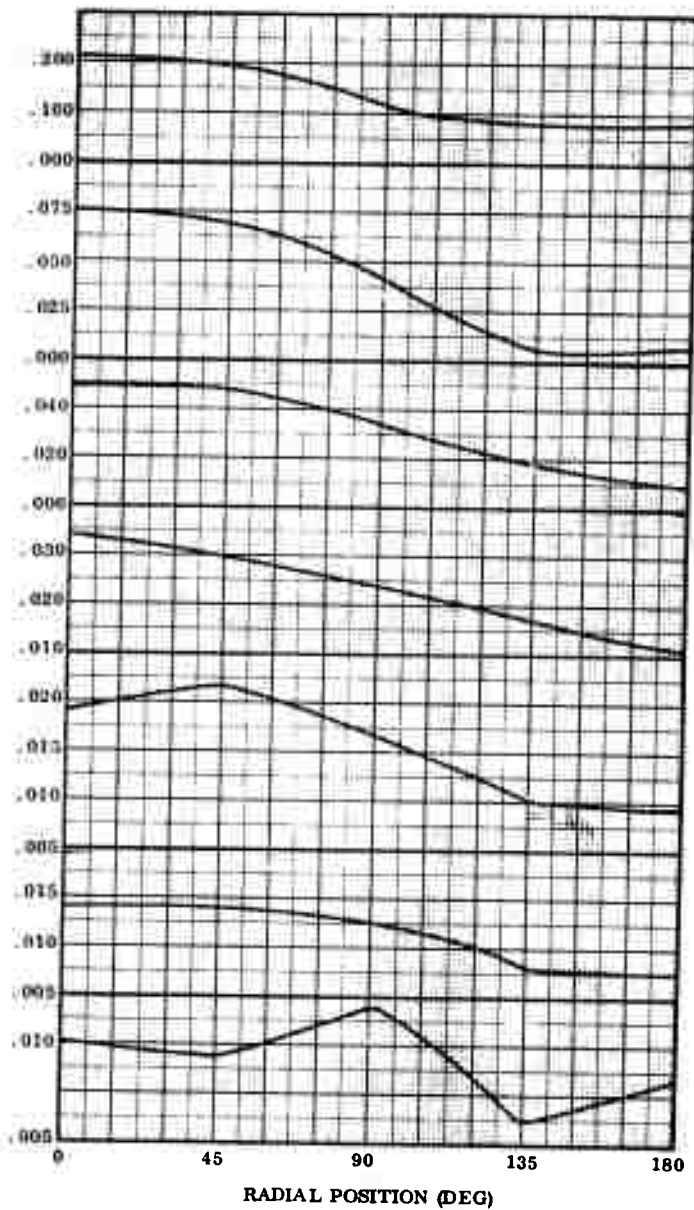
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Flex-X Cold Flow Run No. 6 , Vector Angle 0 Degrees

Flex-X Cold Flow Run 6 , Vector Angle 2.5 Degrees
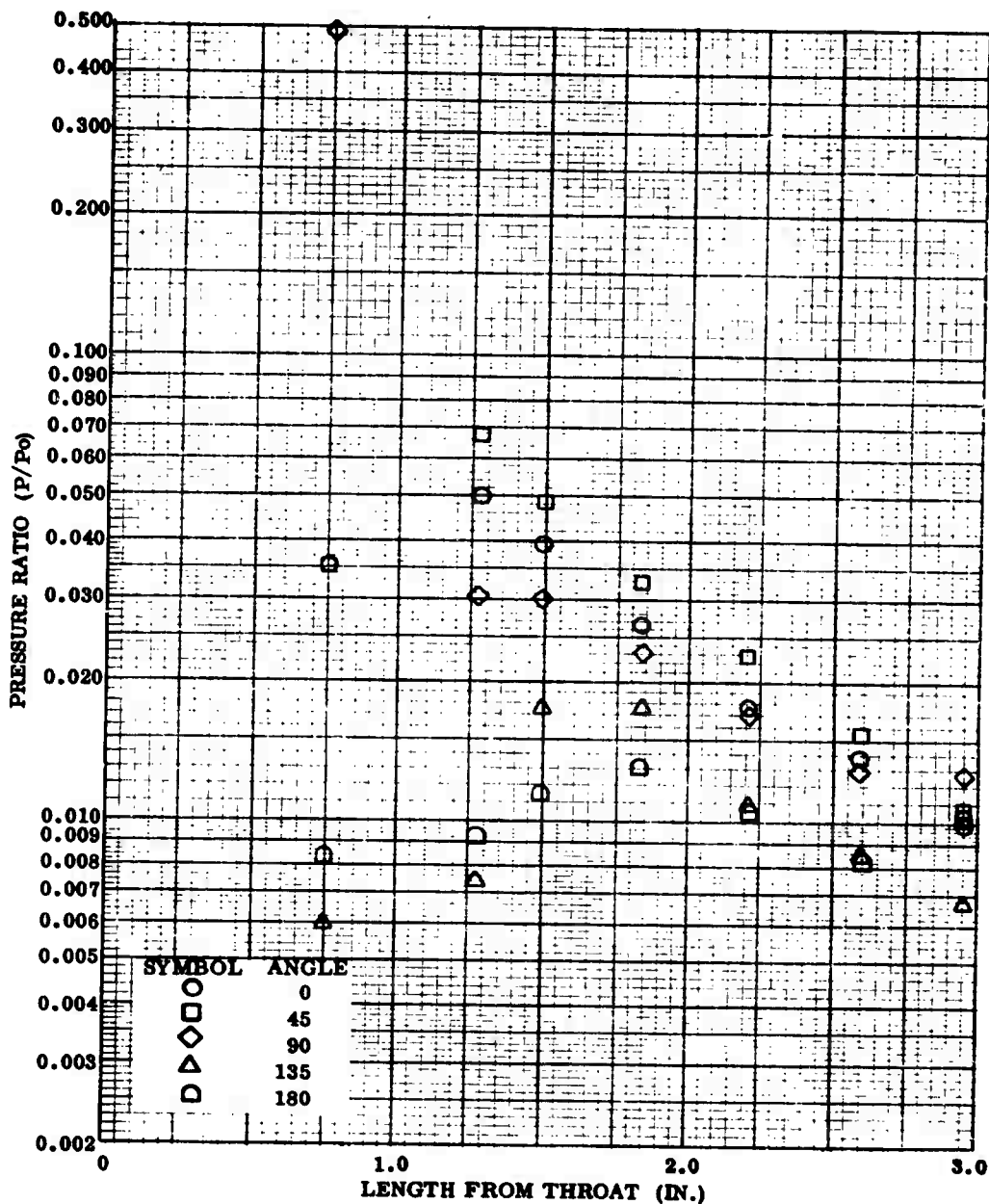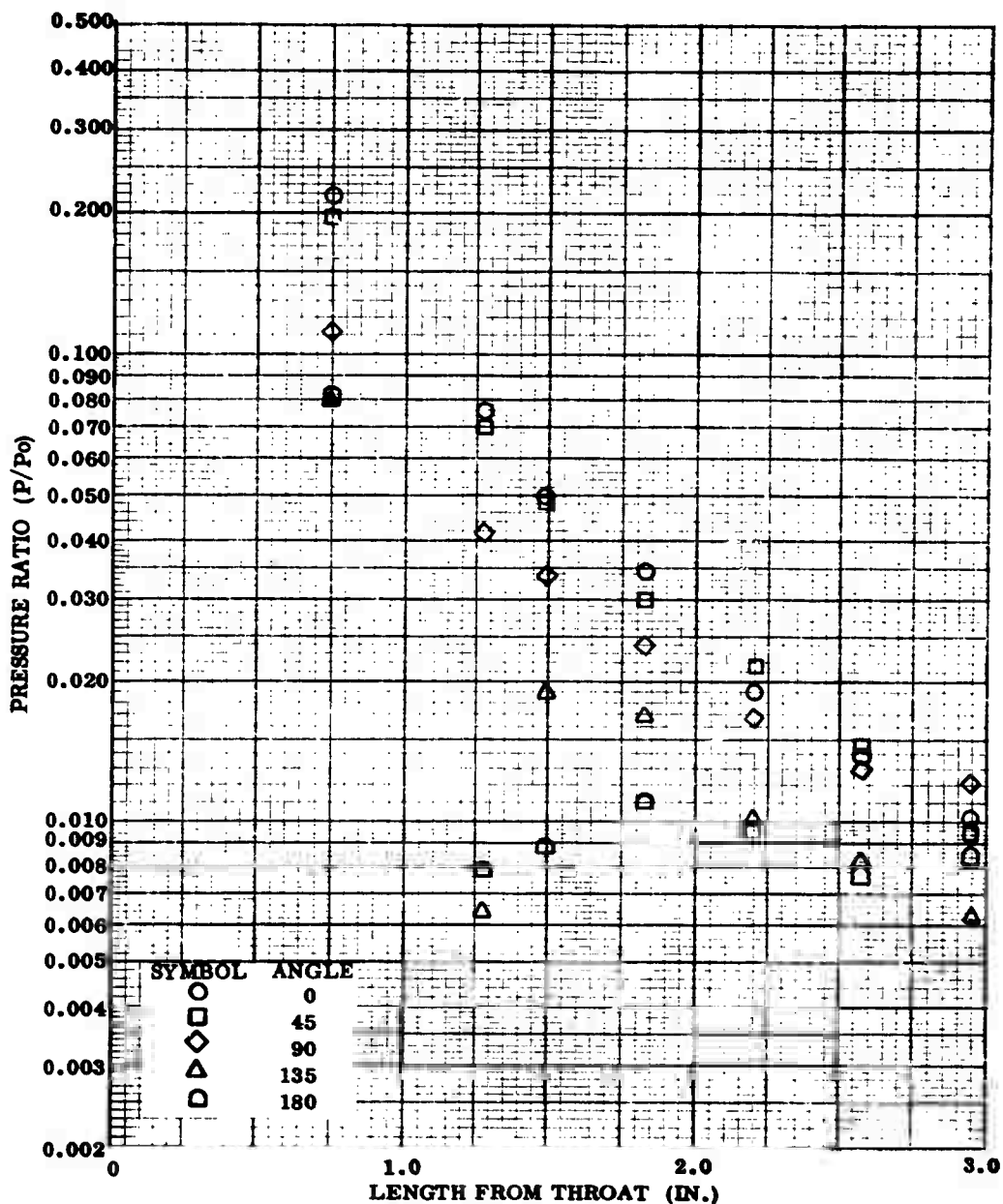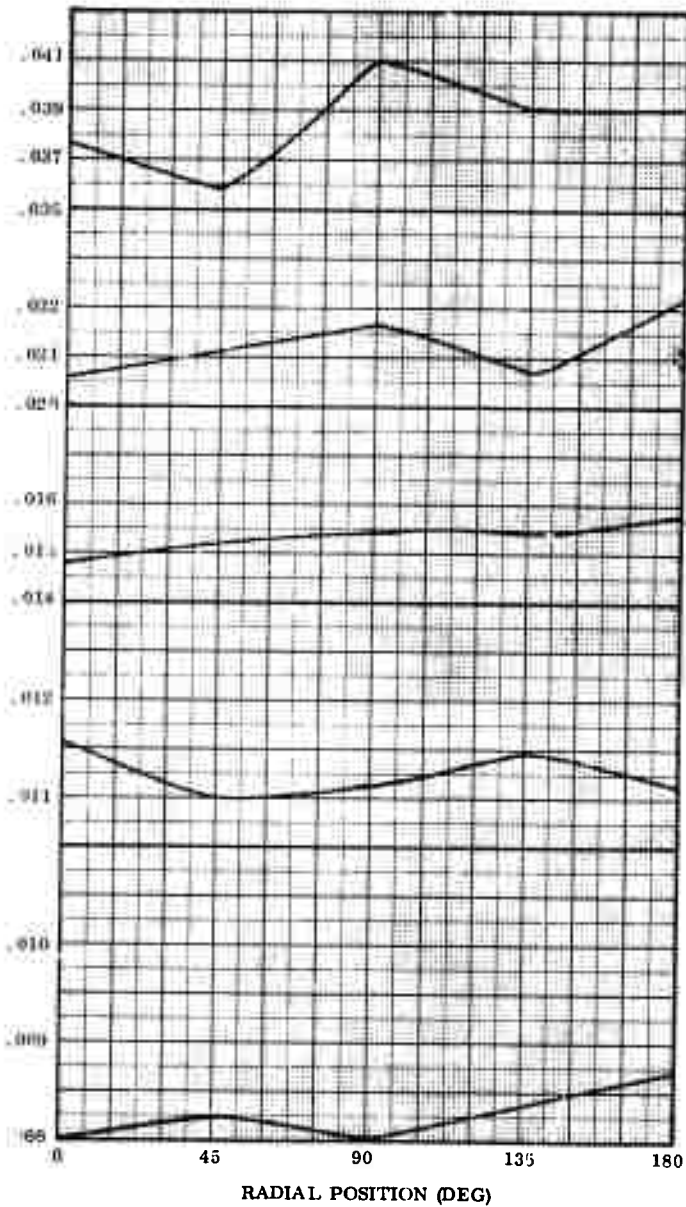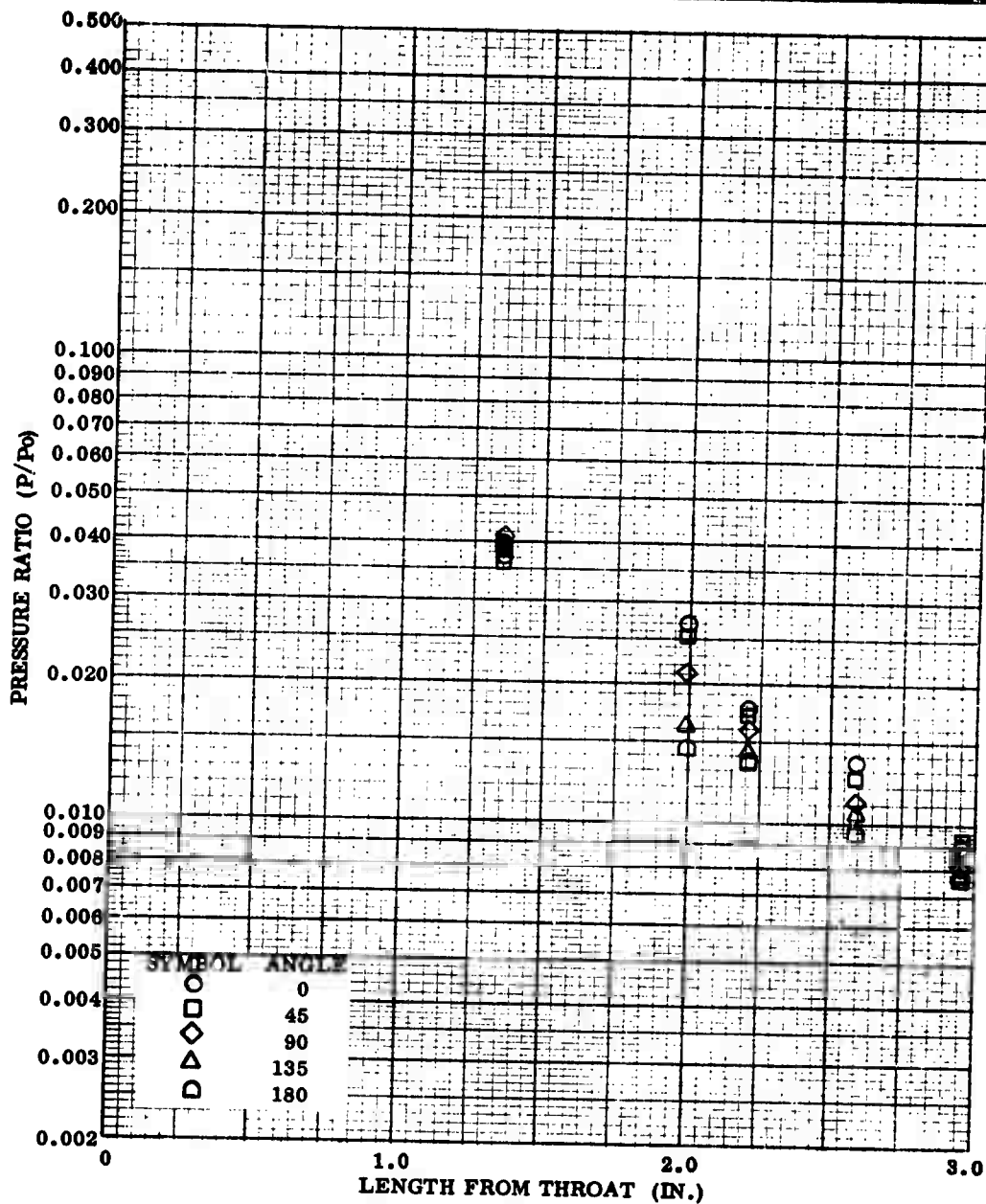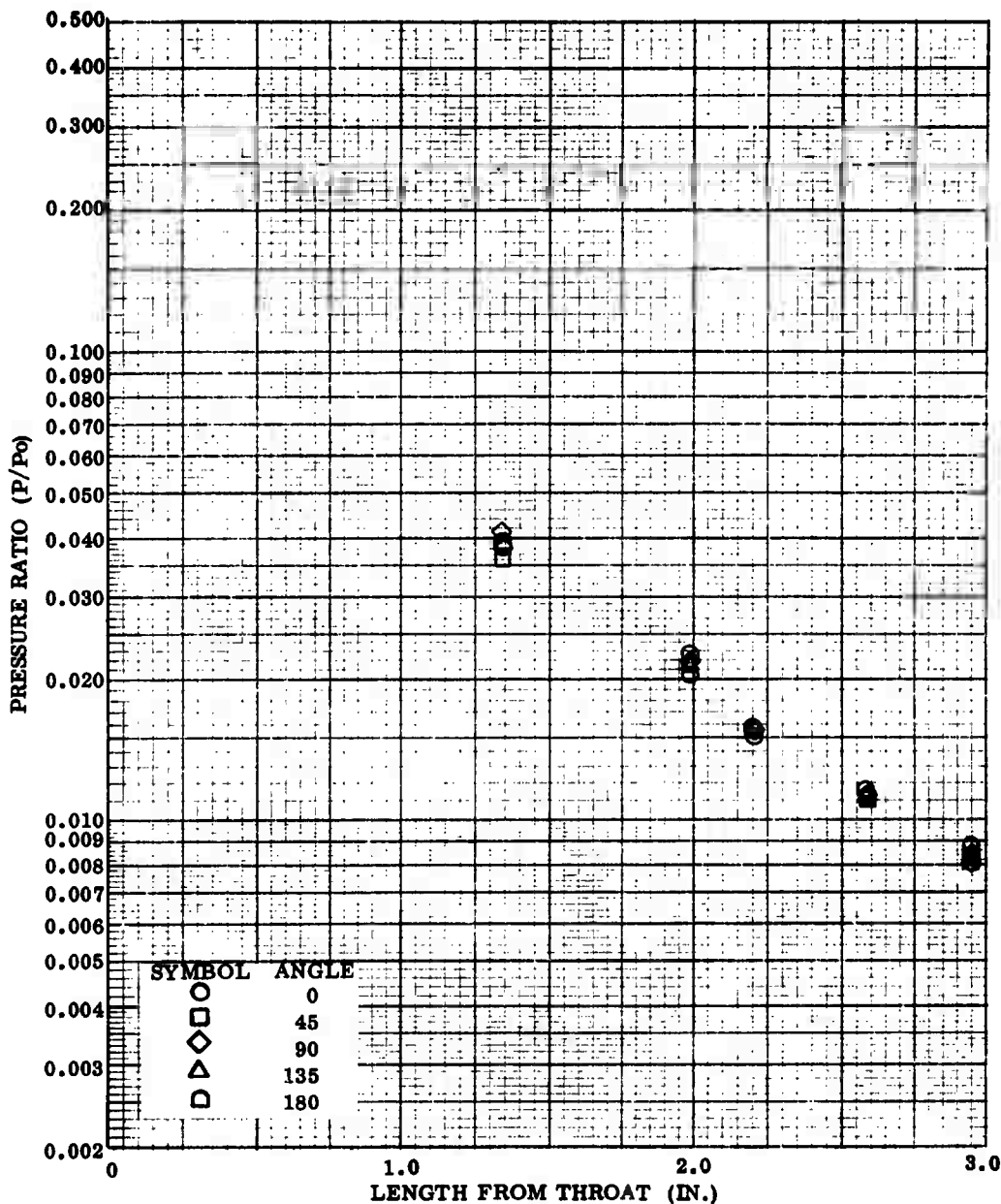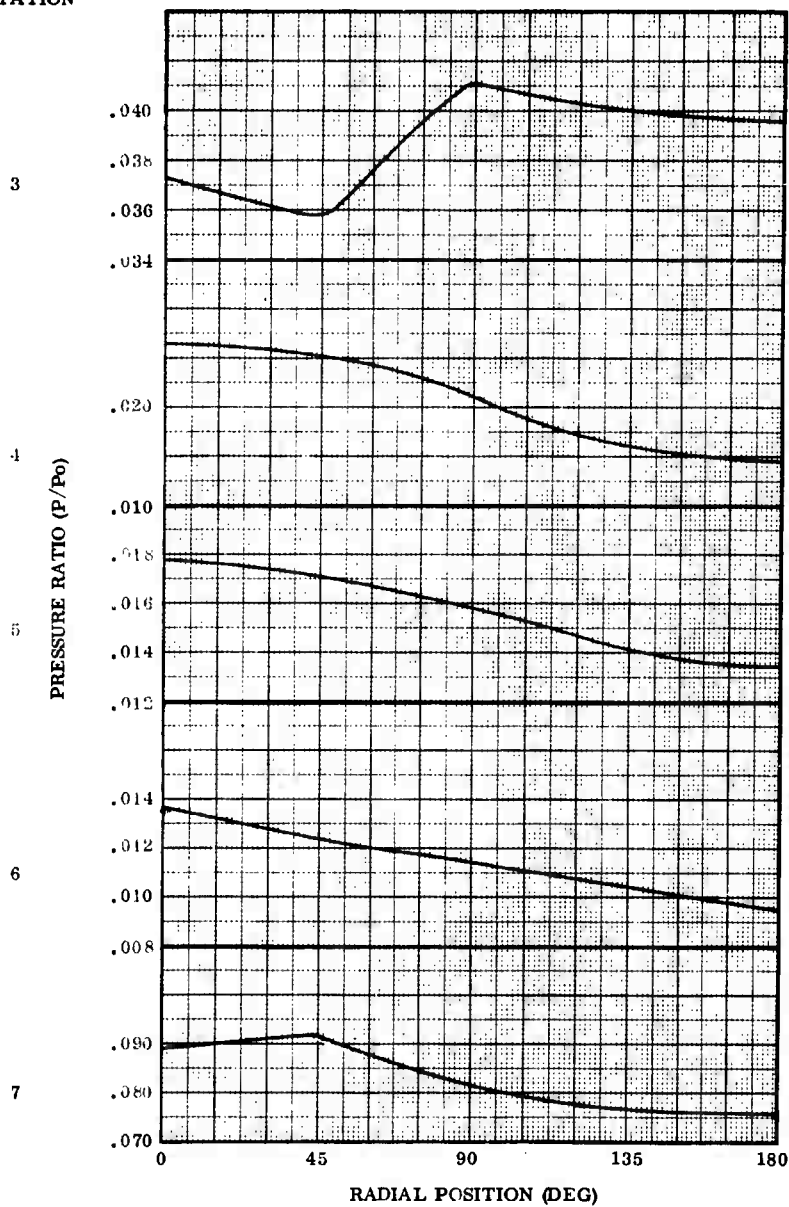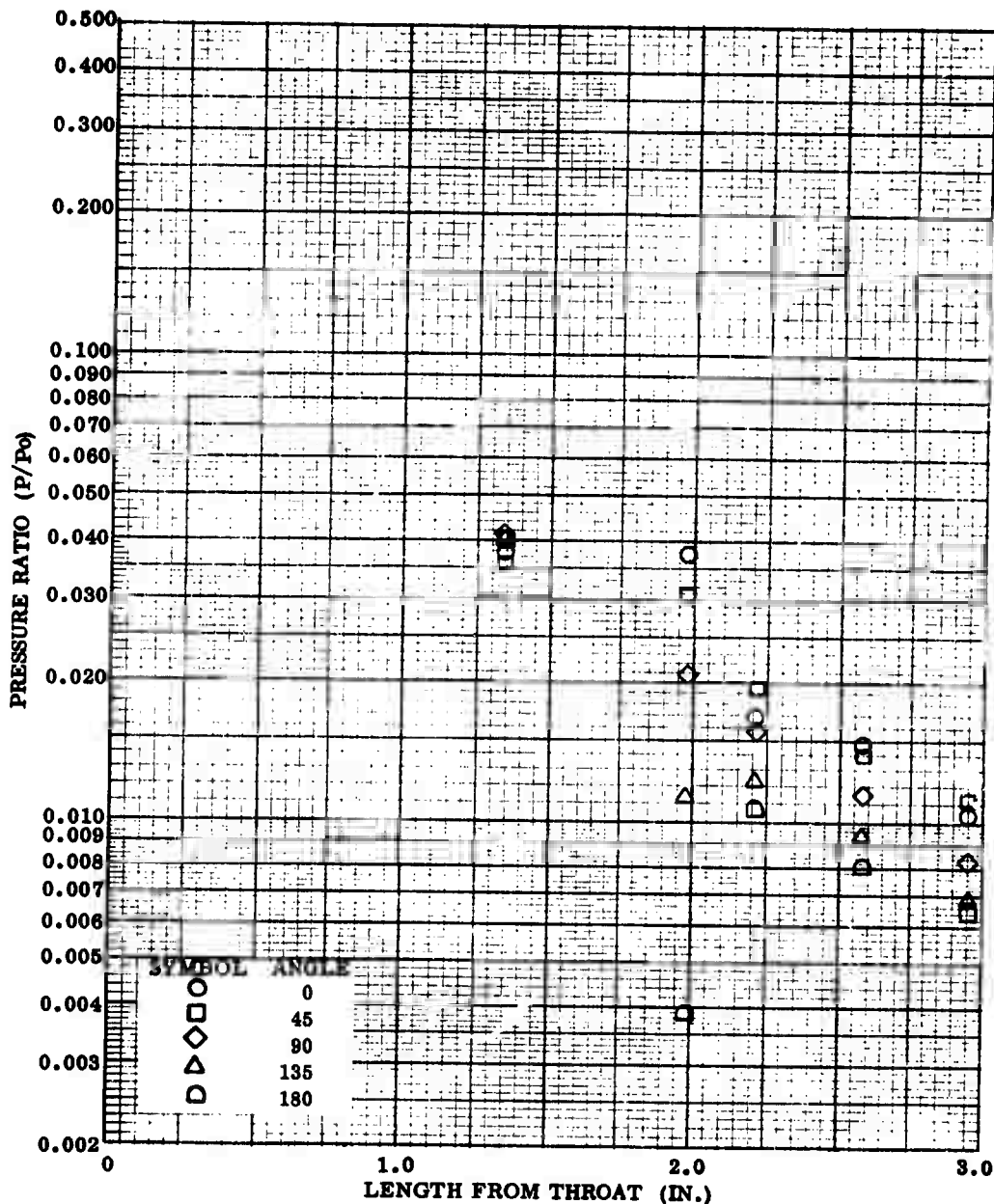
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Flex-X Cold Flow Run No. 6 , Vector Angle 5 Degrees

Flex-X Cold Flow Run No. 6 , Vector Angle 10 Degrees

Flex-X Cold Flow Run 6 , Vector Angle 5 Degrees
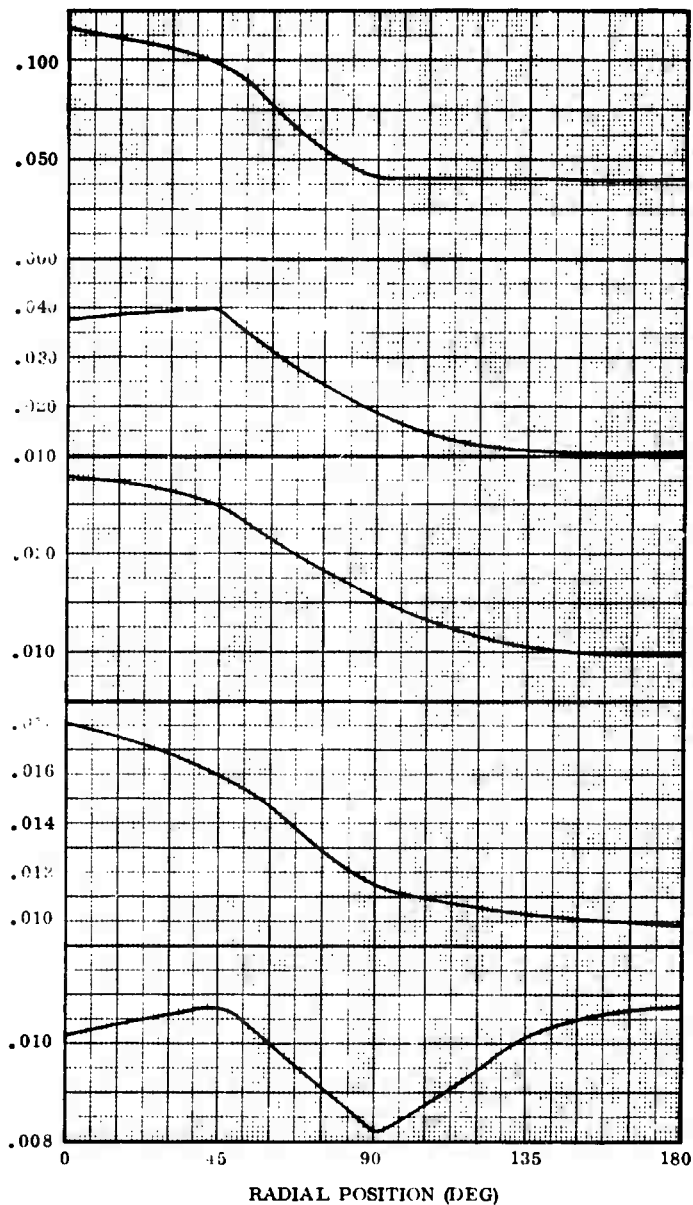
Flex-X Cold Flow Run 6 , Vector Angle 10 Degrees

52

Flex-X Cold Flow Run No. 7 , Vector Angle 0 Degrees

Flex-X Cold Flow Run No. 7 , Vector Angle 3.5 Degrees
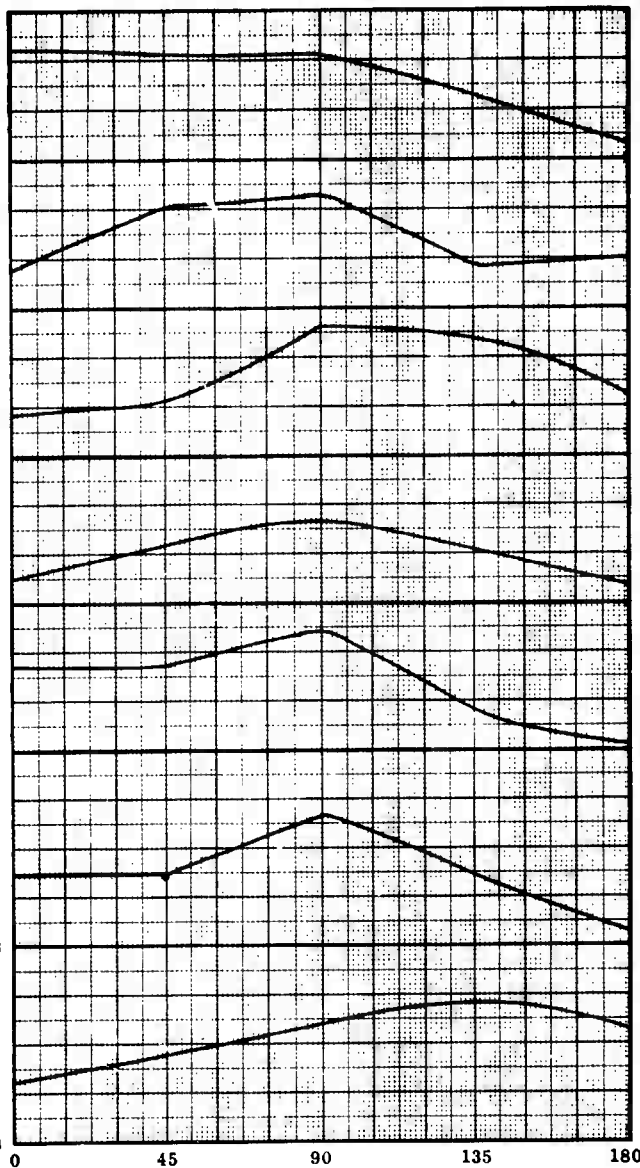
Flex-X Cold Flow Run 7 , Vector Angle 0 Degrees

Flex-X Cold Flow Run 7 , Vector Angle 3.5 Degrees
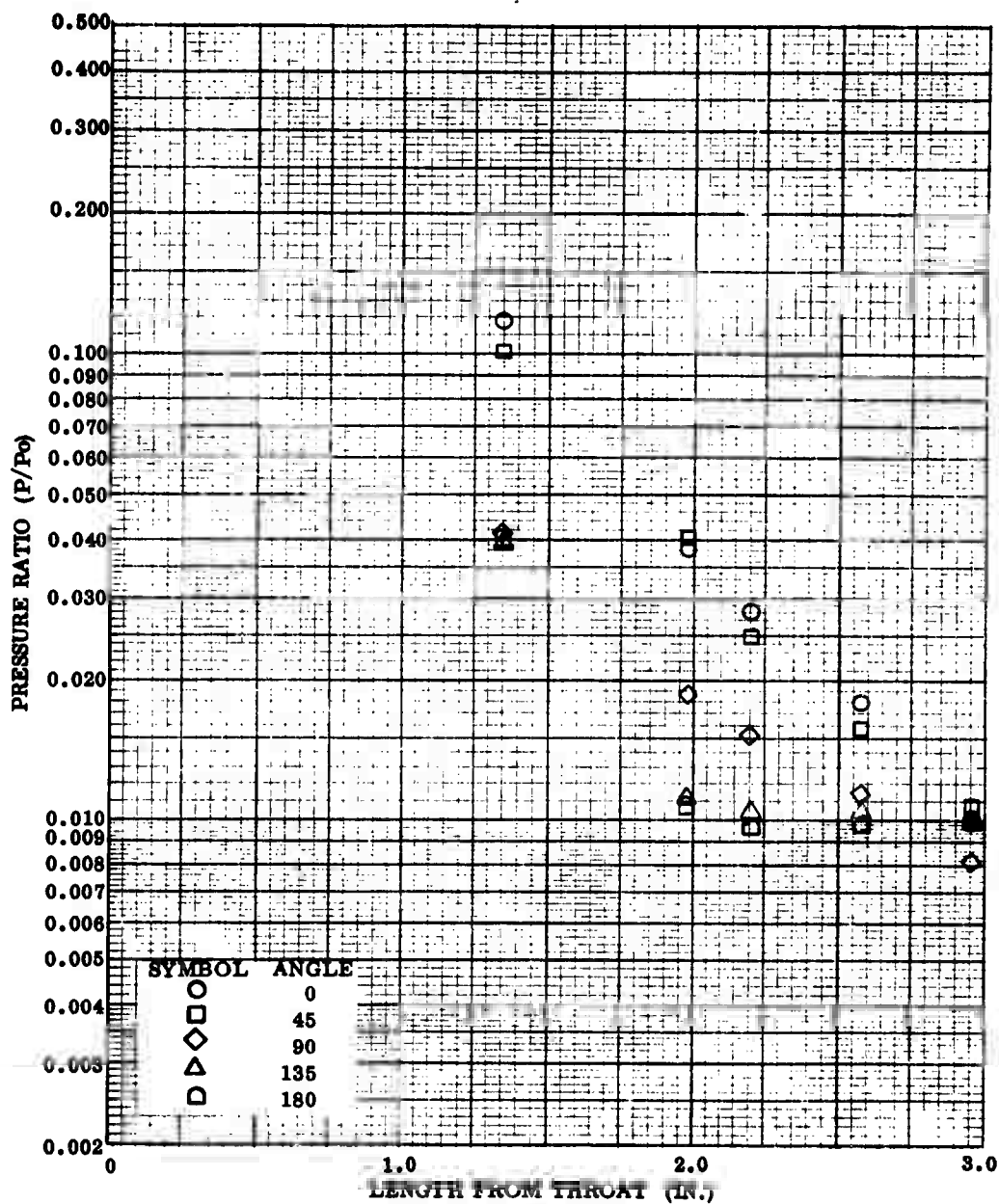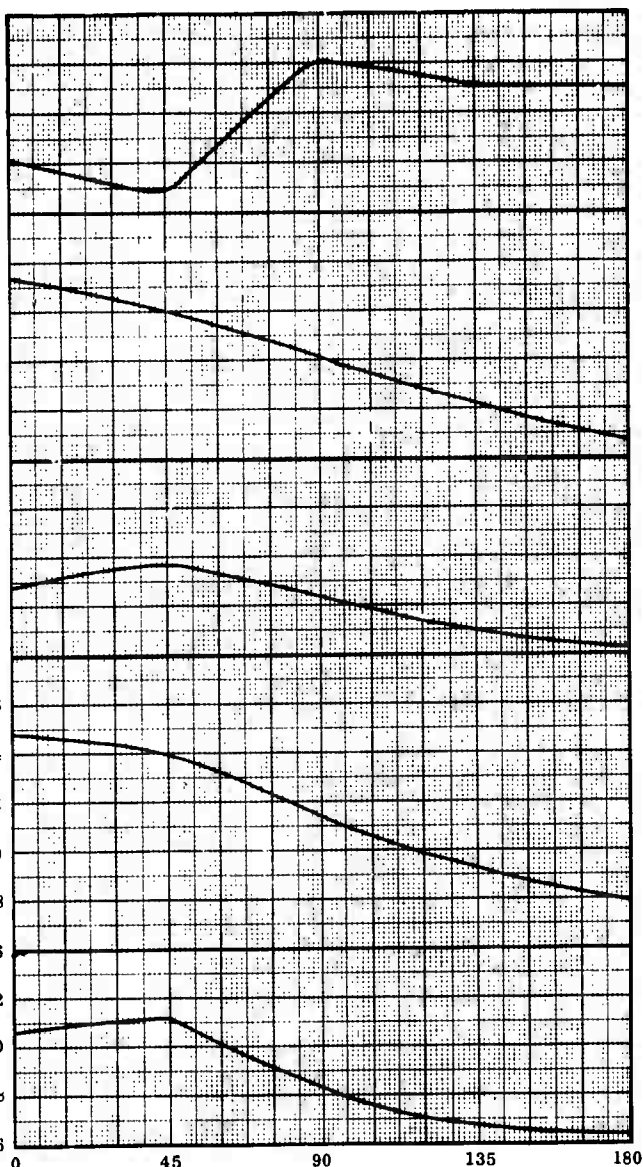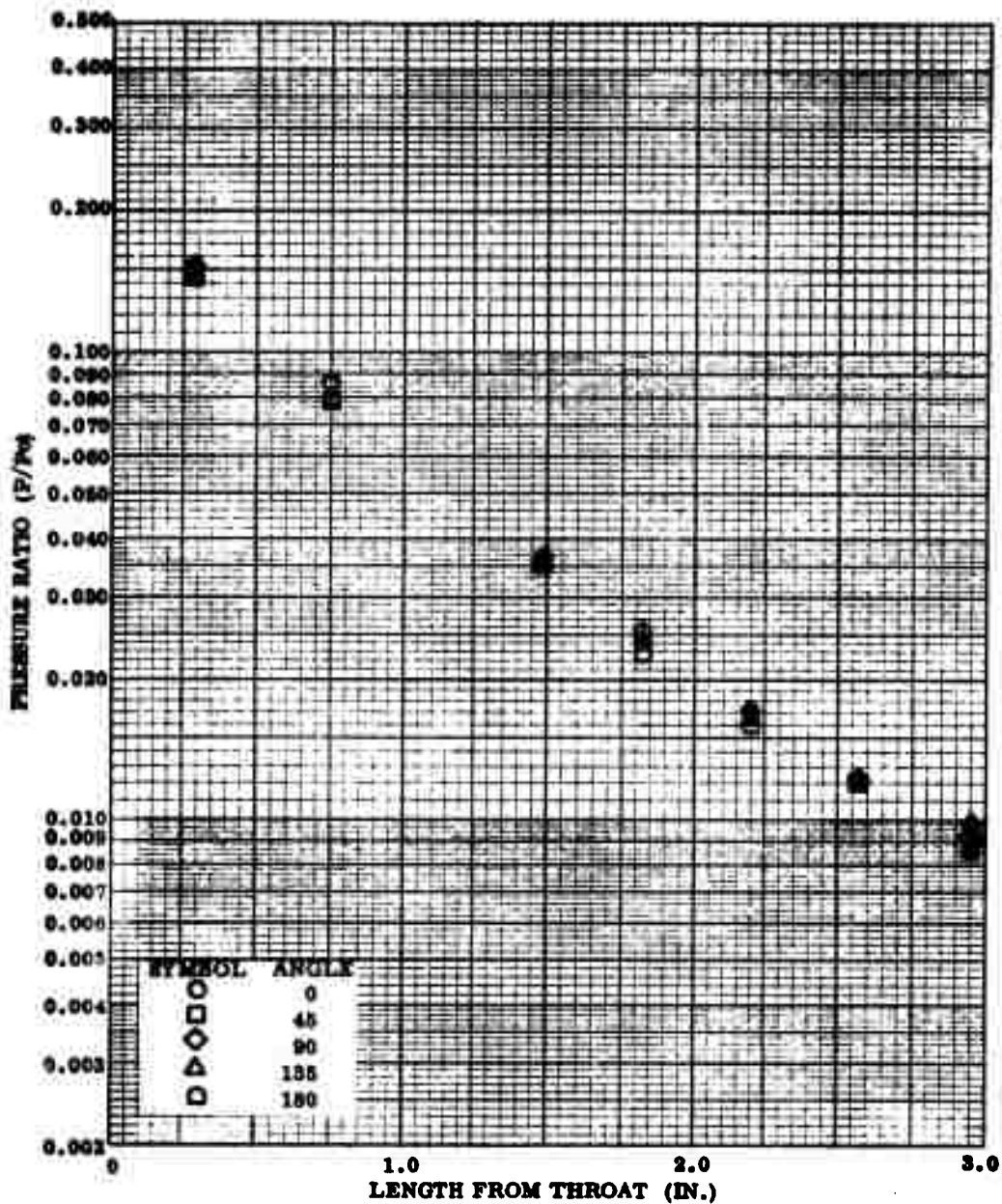
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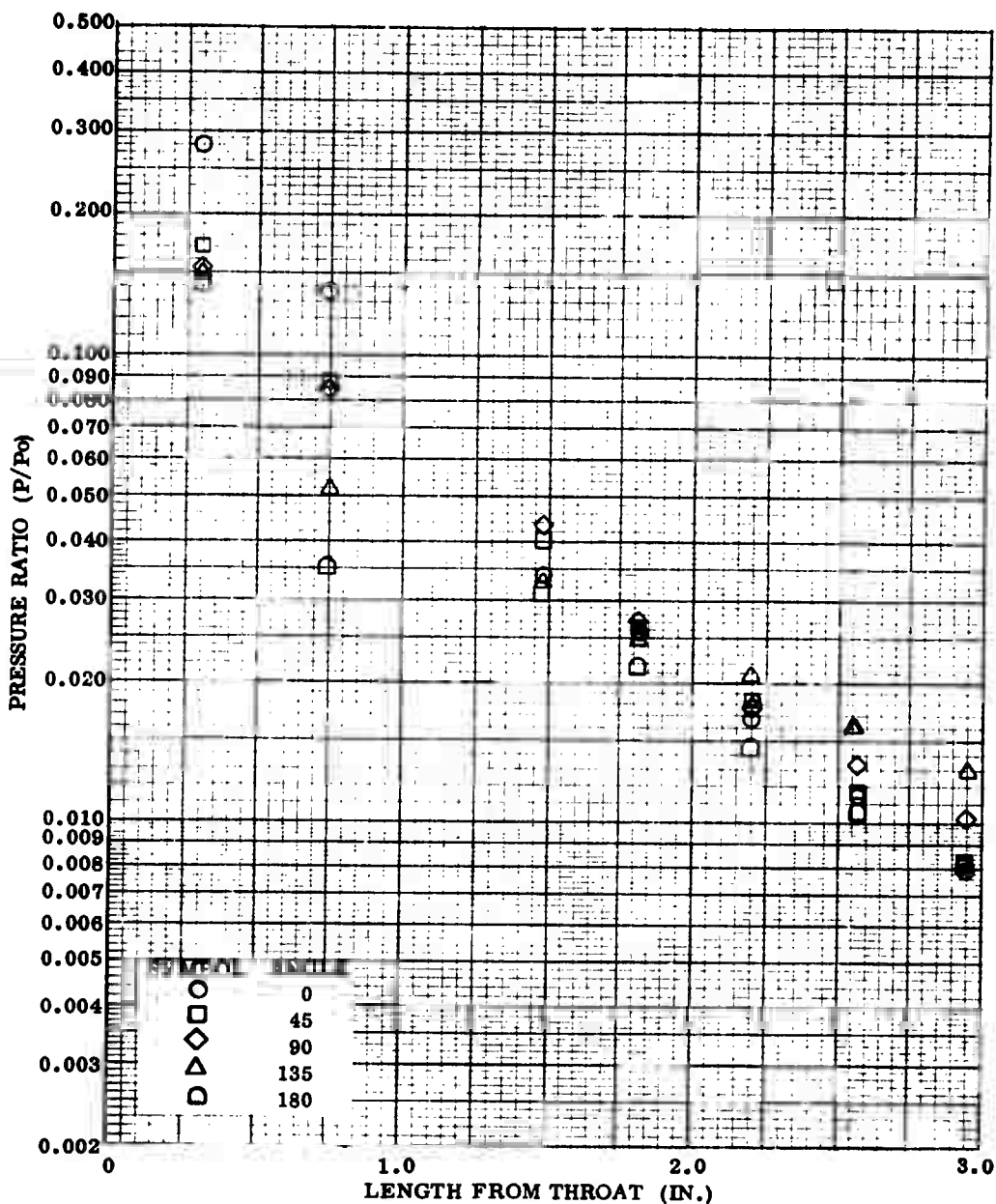
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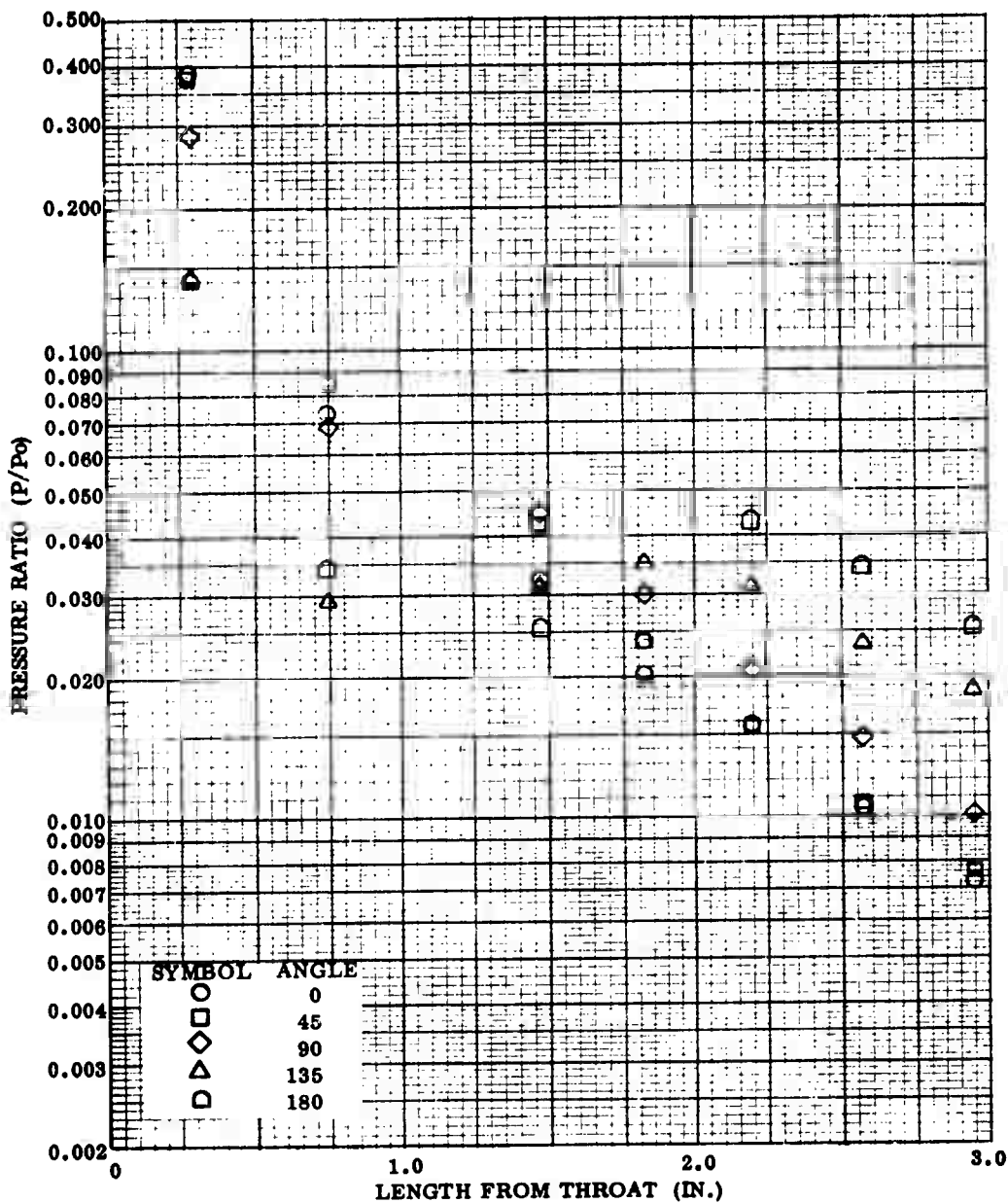
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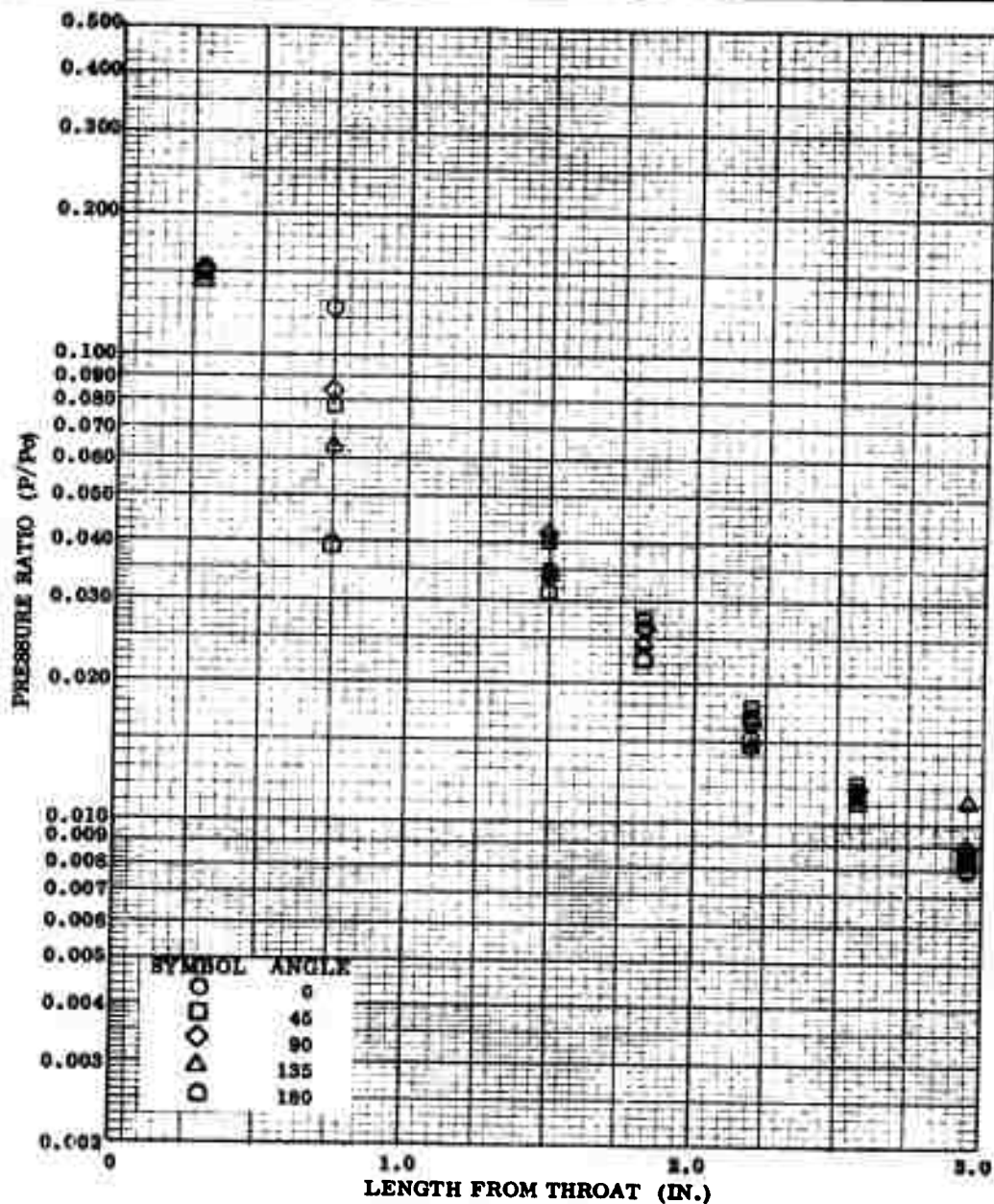
Flex-X Cold Flow Run 7, Vector Angle 5 Degrees

Flex-X Cold Flow Run 7 , Vector Angle 10 Degrees

Flex-X Cold Flow Run No. 8 , Vector Angle 2.5 Degrees

Flex-X Cold Flow Run No. 8 , Vector Angle 0 Degrees

Flex-X Cold Flow Run 8 , Vector Angle 25 Degrees

Flex-X Cold Flow Run 8 , Vector Angle 0 Degrees
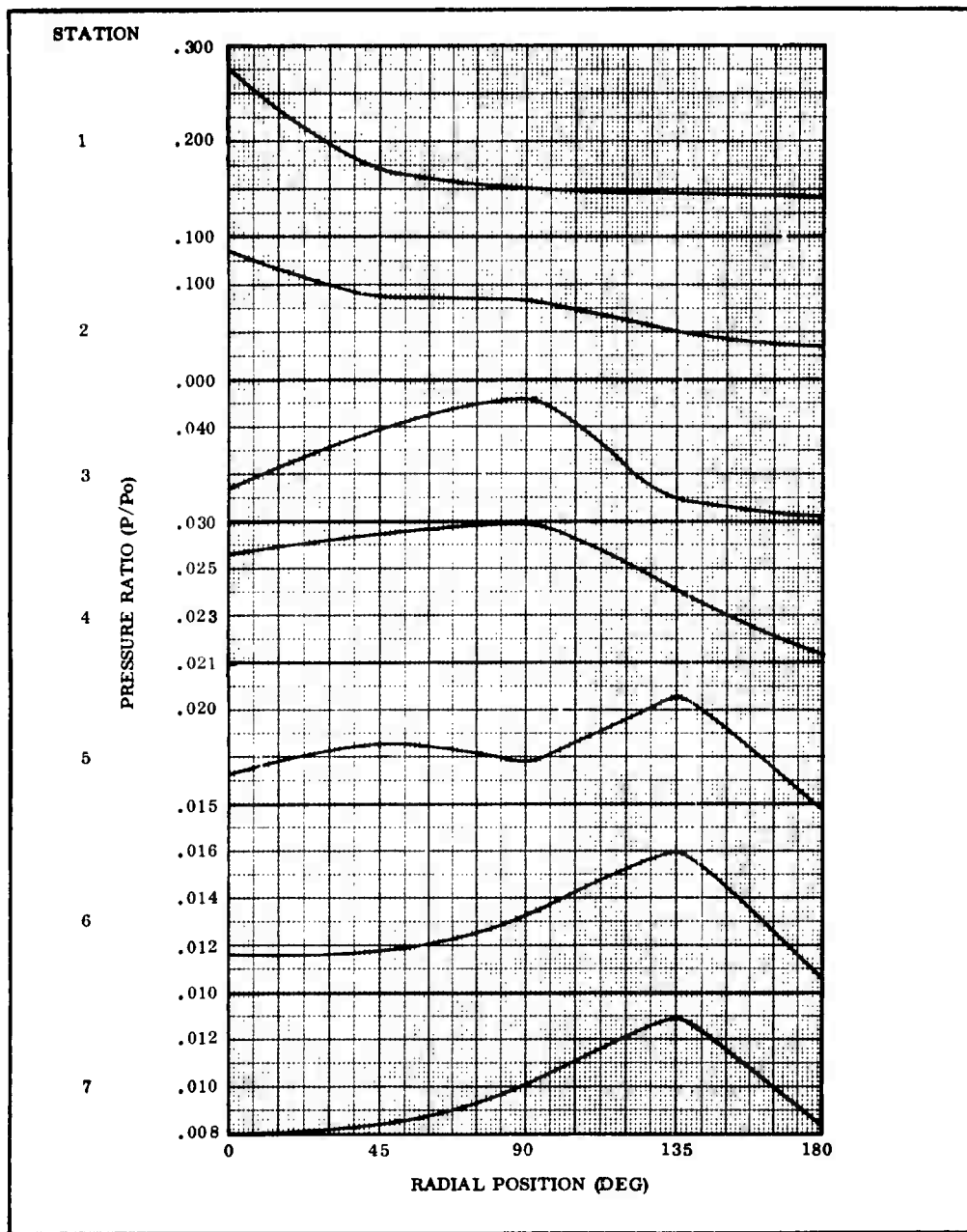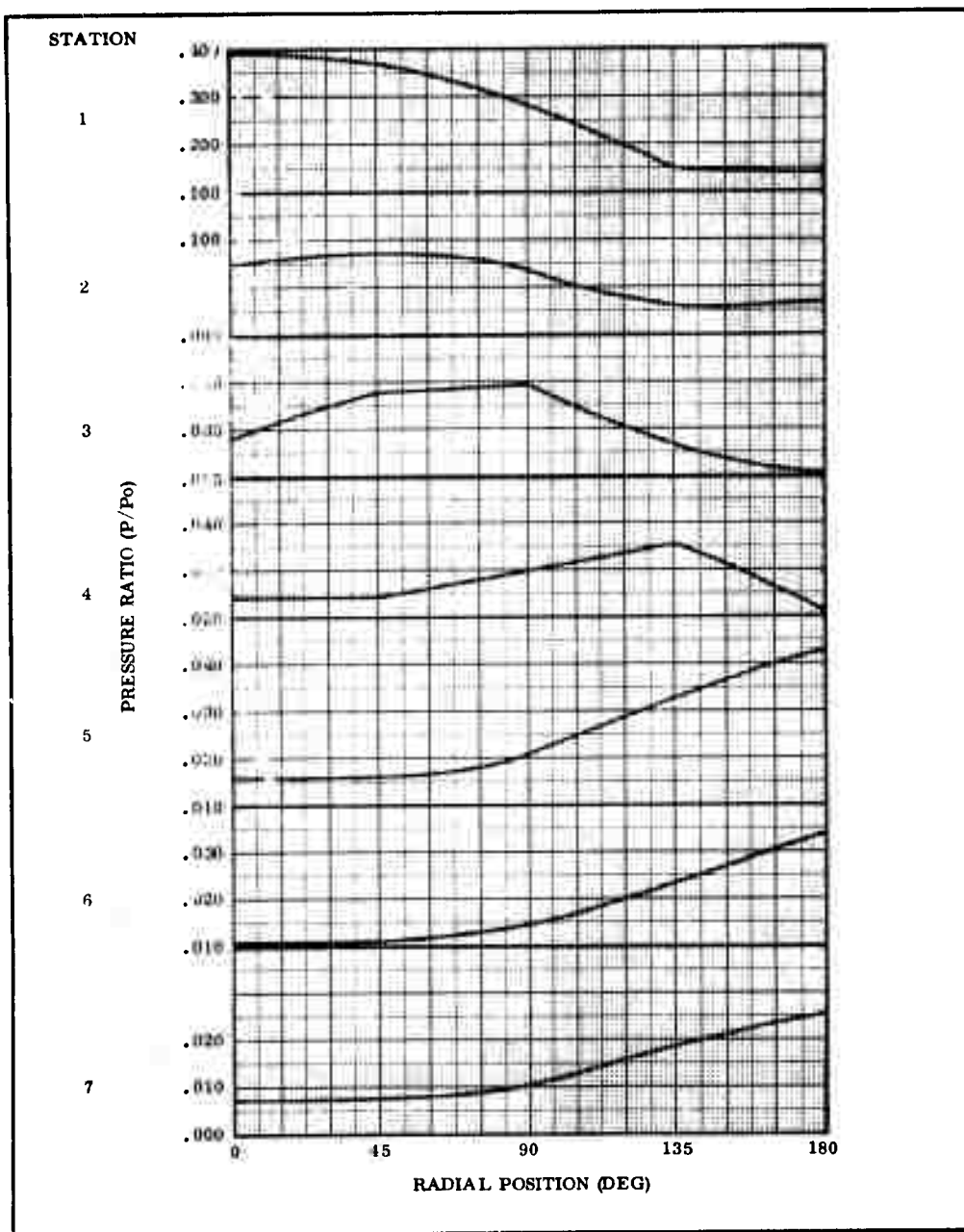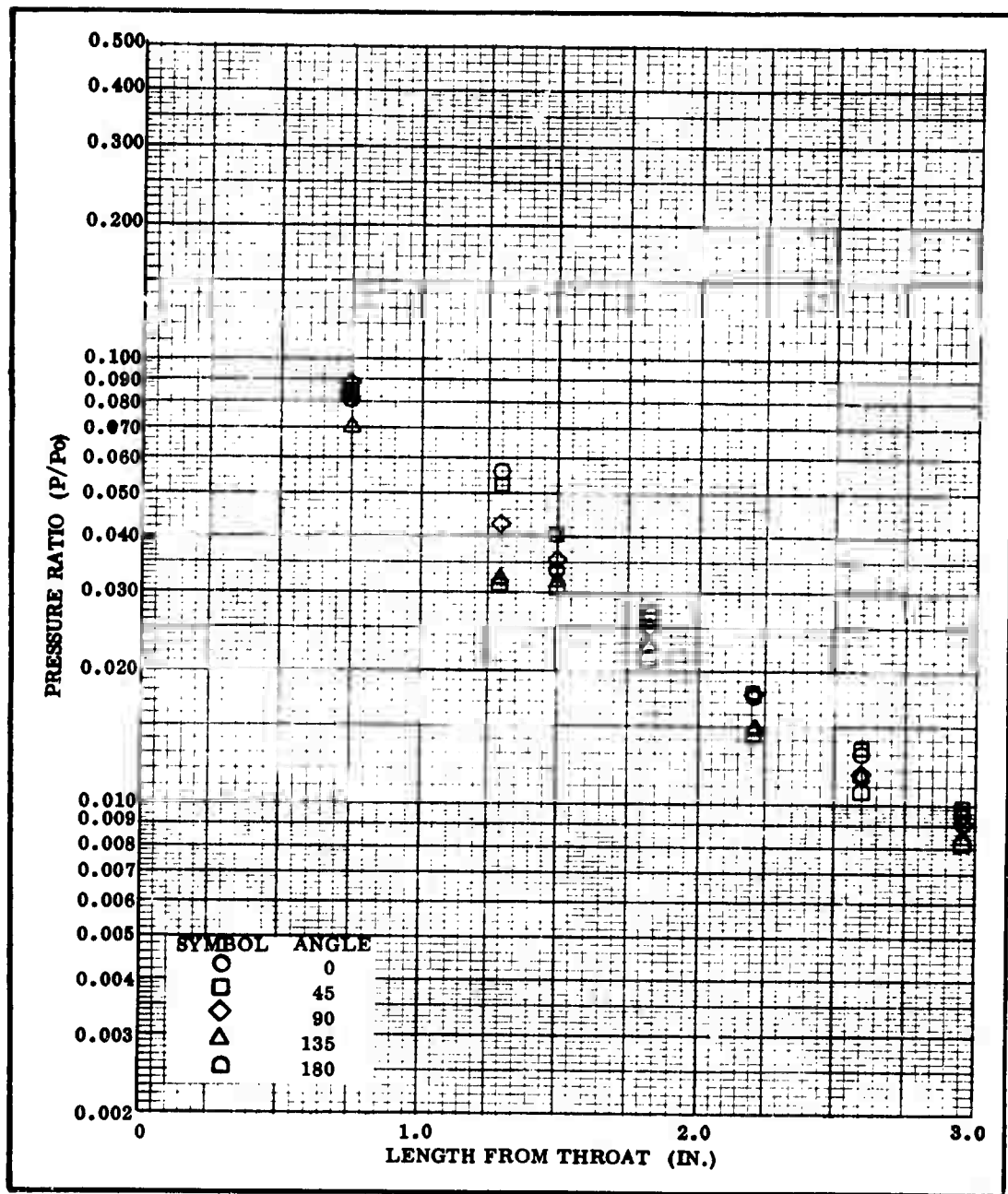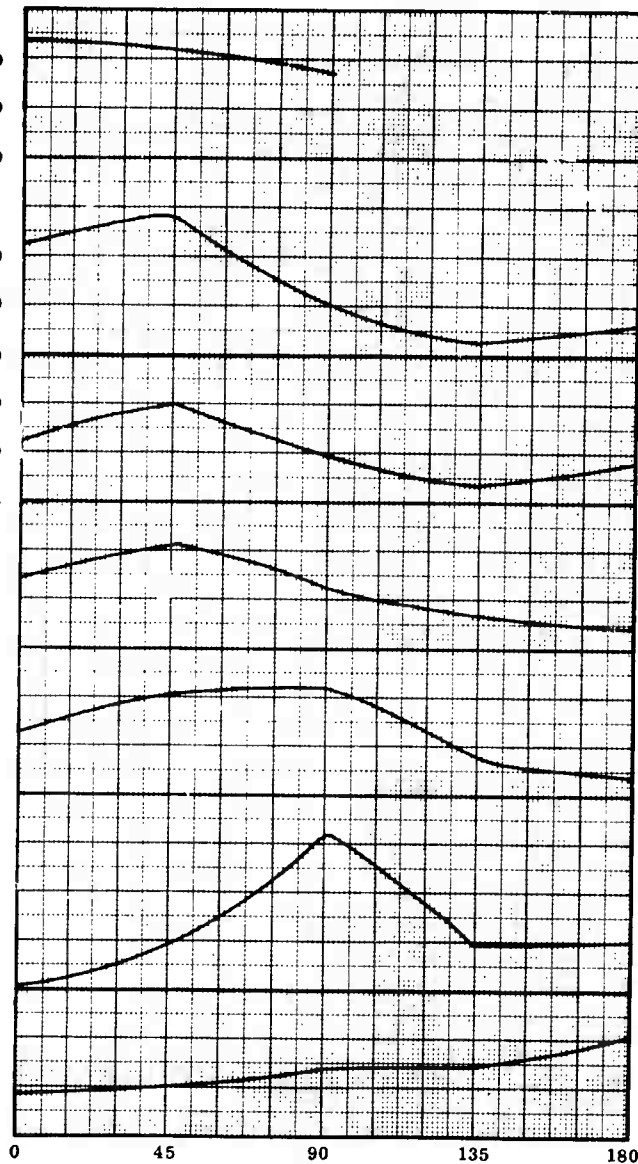
Flex-X Cold Flow Run 8 , Vector Angle 10 Degrees

Flex-X Cold Flow Run 8 , Vector Angle 5 Degrees

PRESSURE RATIO (P/Po)

0.500
0.400
0.300

0.200

0.100
0.090
0.080
0.070
0.060
0.050

0.040

0.030

0.020

0.010
0.009
0.008
0.007
0.006

0.005

0.004

0.003

0.002

0   1.0   2.0   3.0

LENGTH FROM THROAT (IN.)

SYMBOL	ANGLE
○	0
□	45
◇	90
△	135
⬡	180
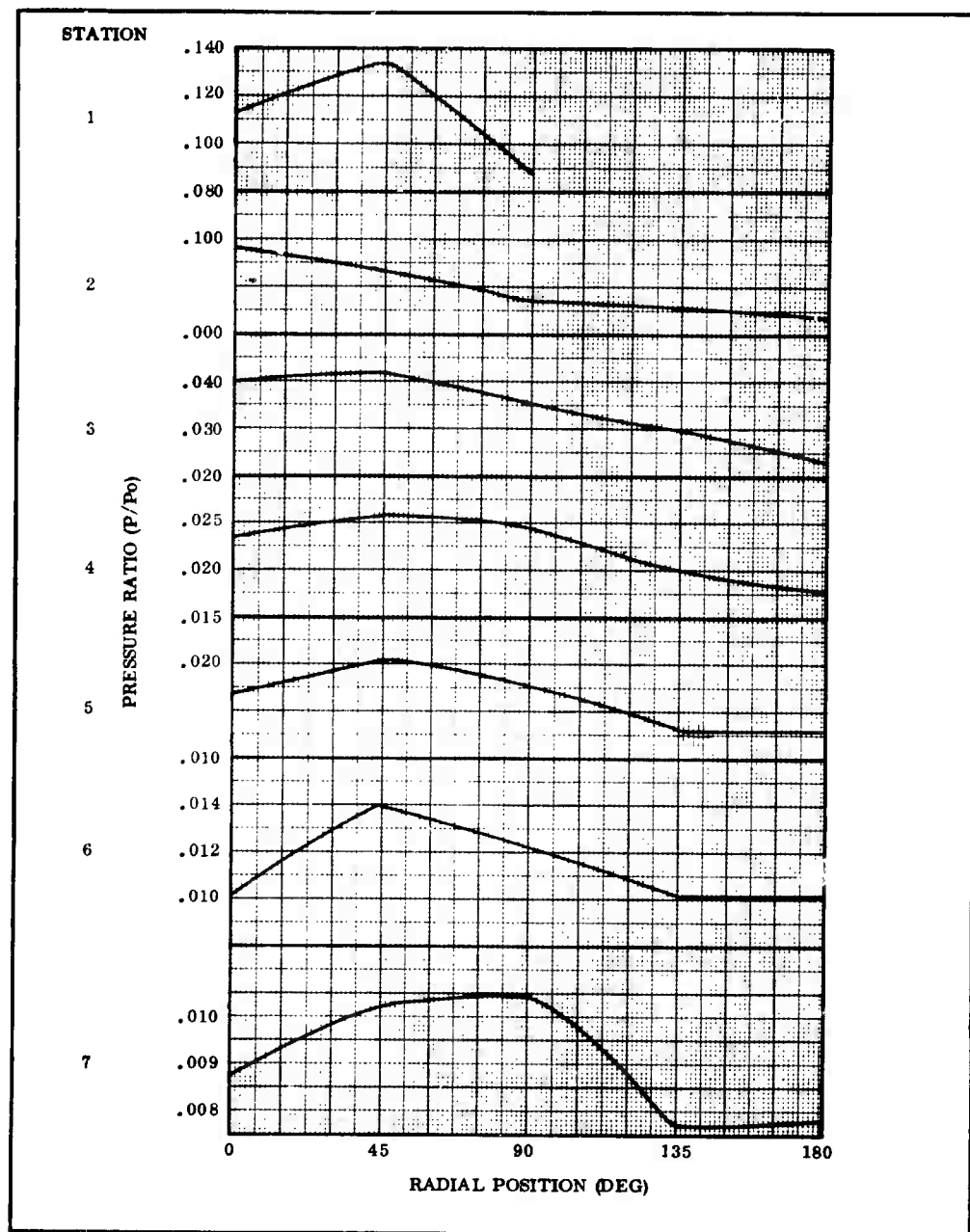
Flex-X Cold Flow Run No. 8 , Vector Angle 10 Degrees

67

Flex-X Cold Flow Run No. 8 , Vector Angle 5 Degrees

Flex-X Cold Flow Run 9, Vector Angle 0 Degrees

69

Flex-X Cold Flow Run No. 9 , Vector Angle 2.5 Degrees

Flex-X Cold Flow Run No. 9 , Vector Angle 0 Degrees

71

Flex-X Cold Flow Run 9 , Vector Angle 2.5 Degrees

Flex-X Cold Flow Run No. 9 , Vector Angle 5 Degrees

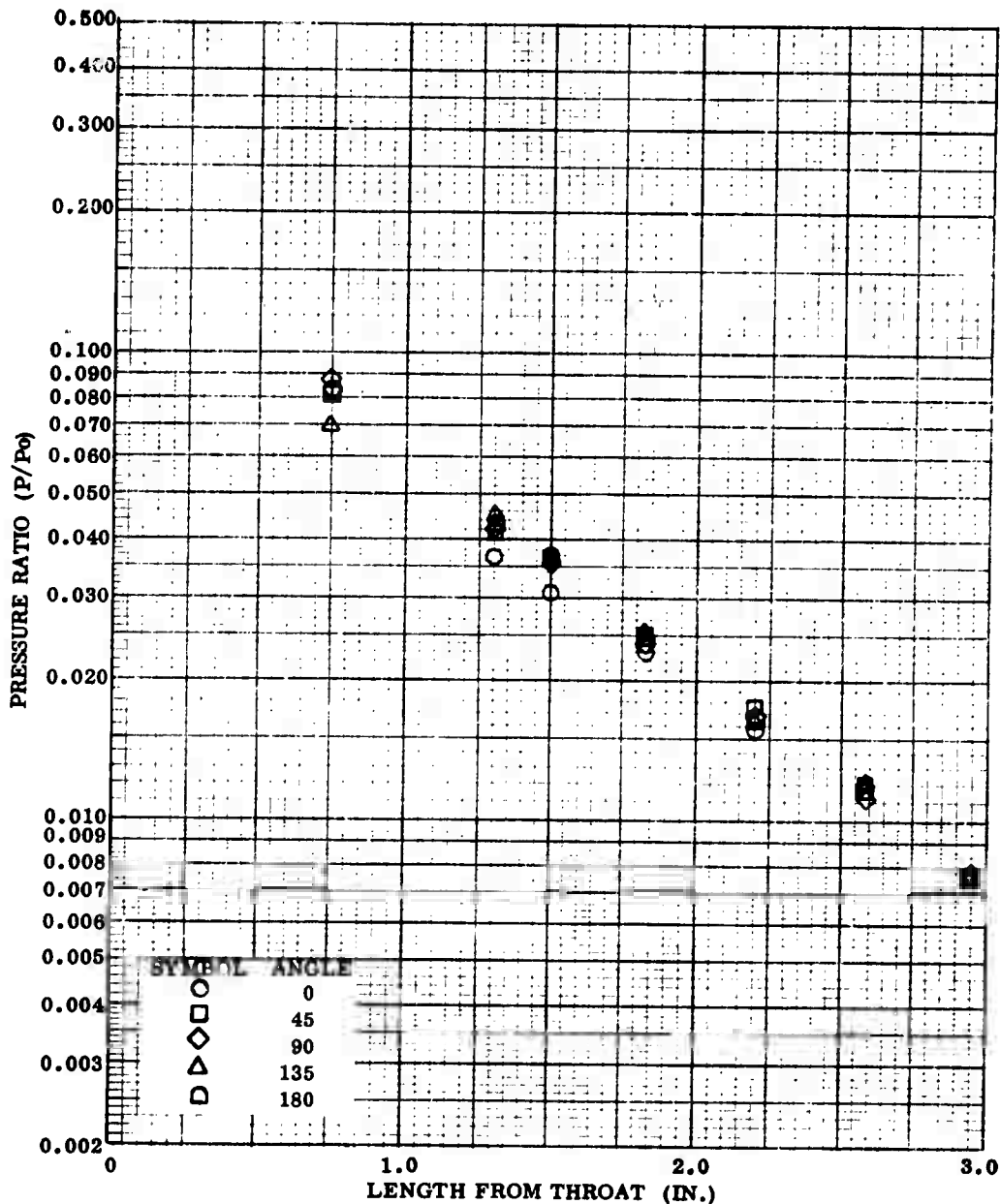Flex-X Cold Flow Run No. 9 , Vector Angle 10 Degrees

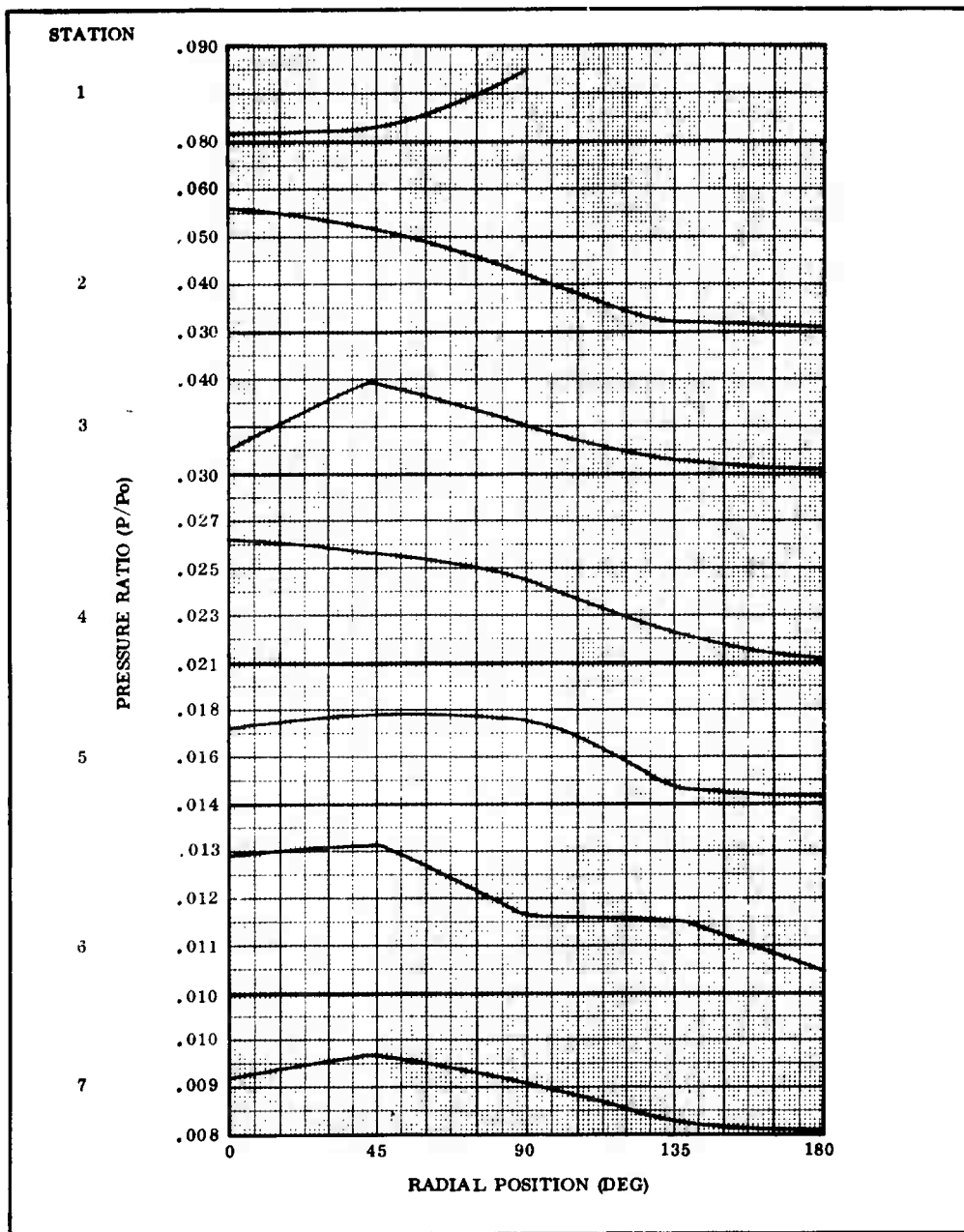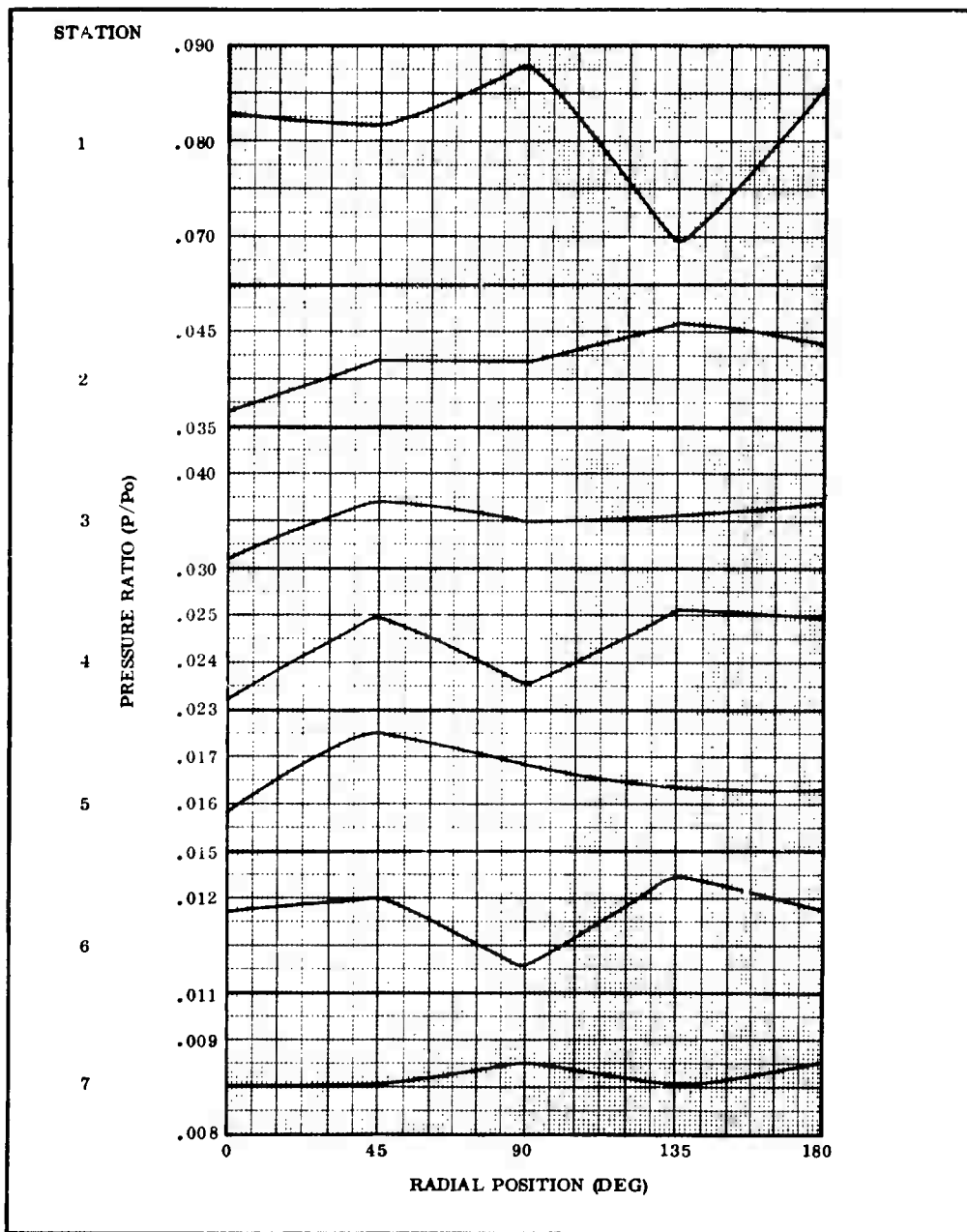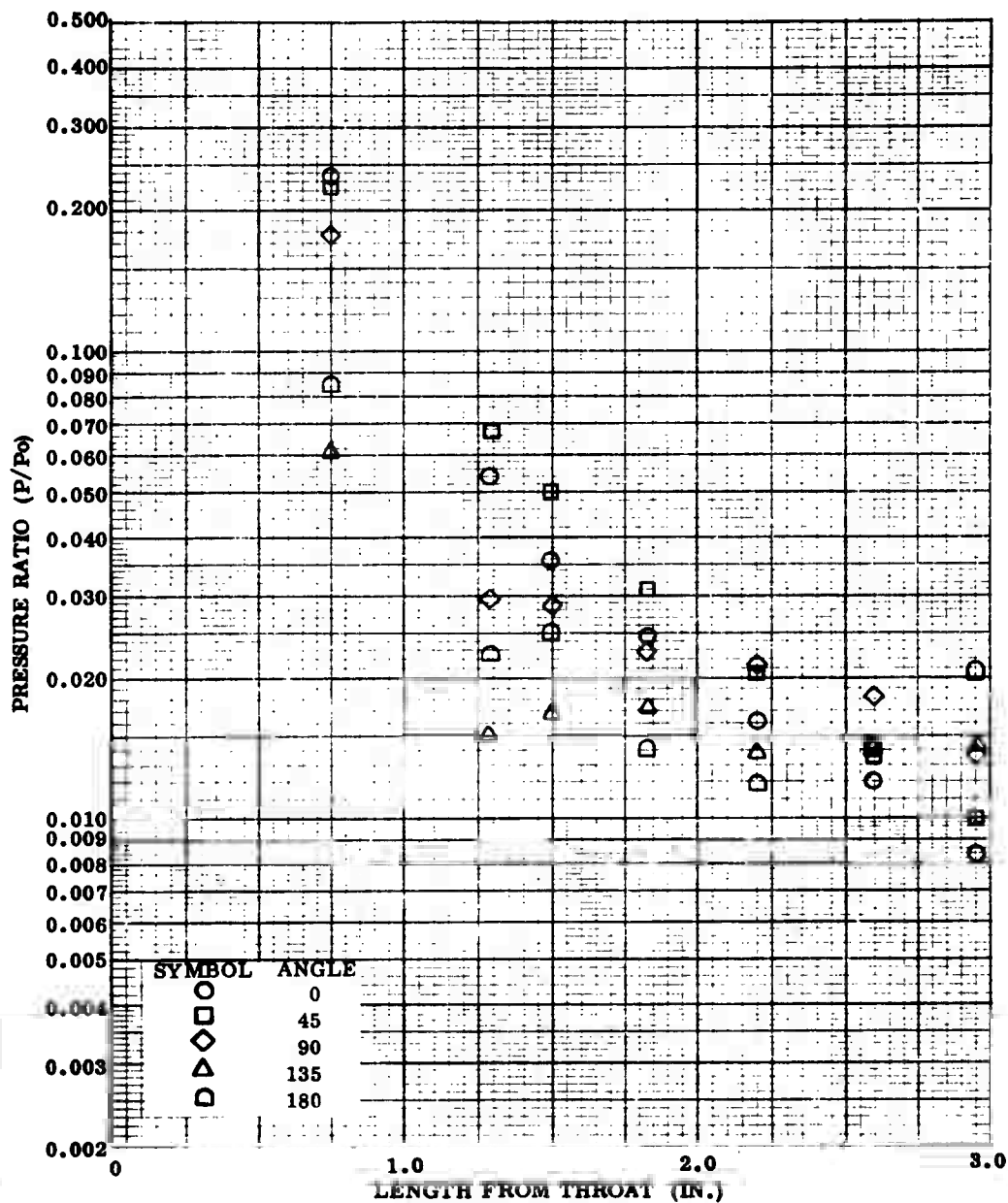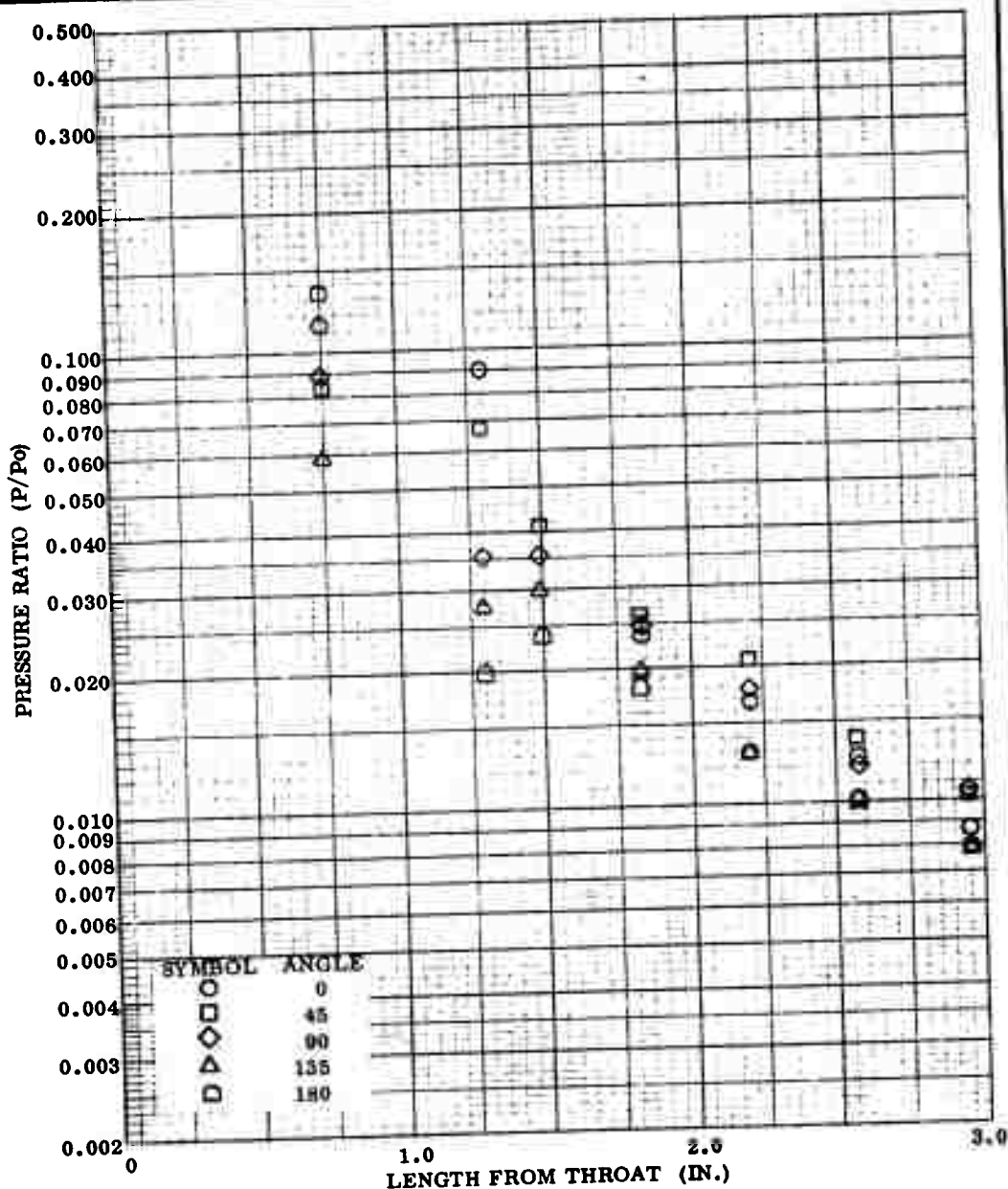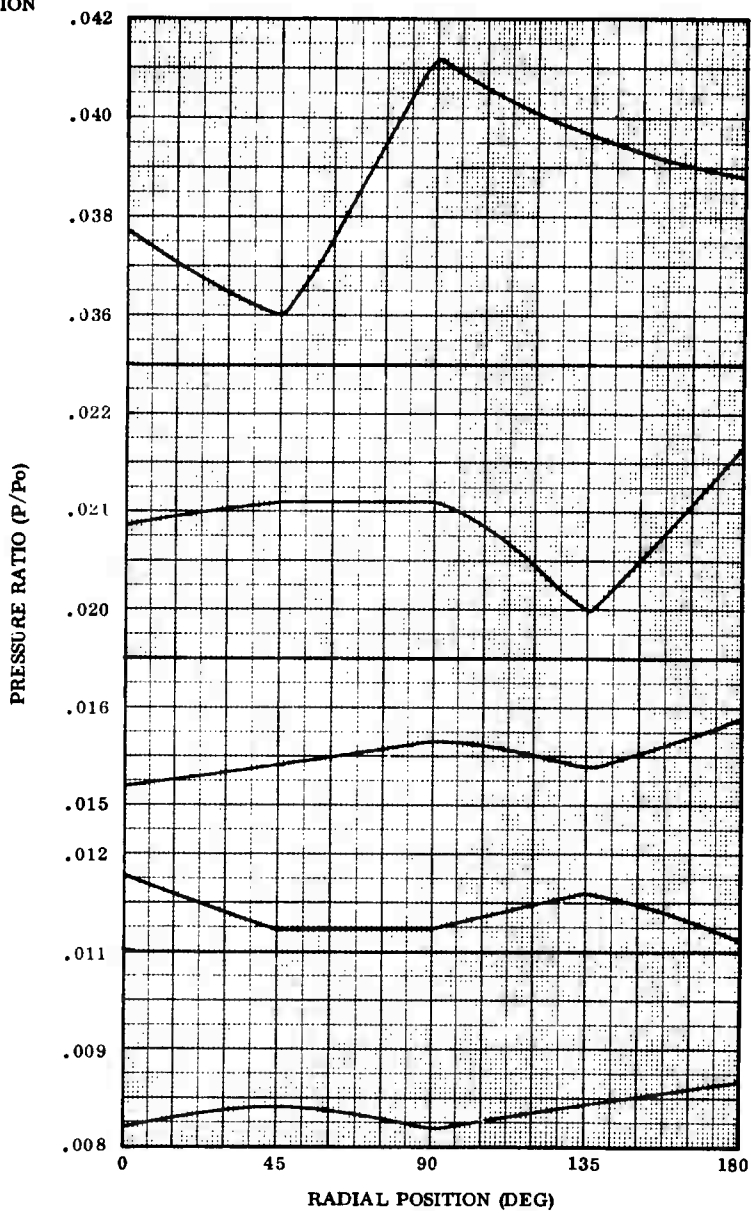Flex-X Cold Flow Run 9 , Vector Angle 5 Degrees

Flex-X Cold Flow Run 9, Vector Angle 10 Degrees
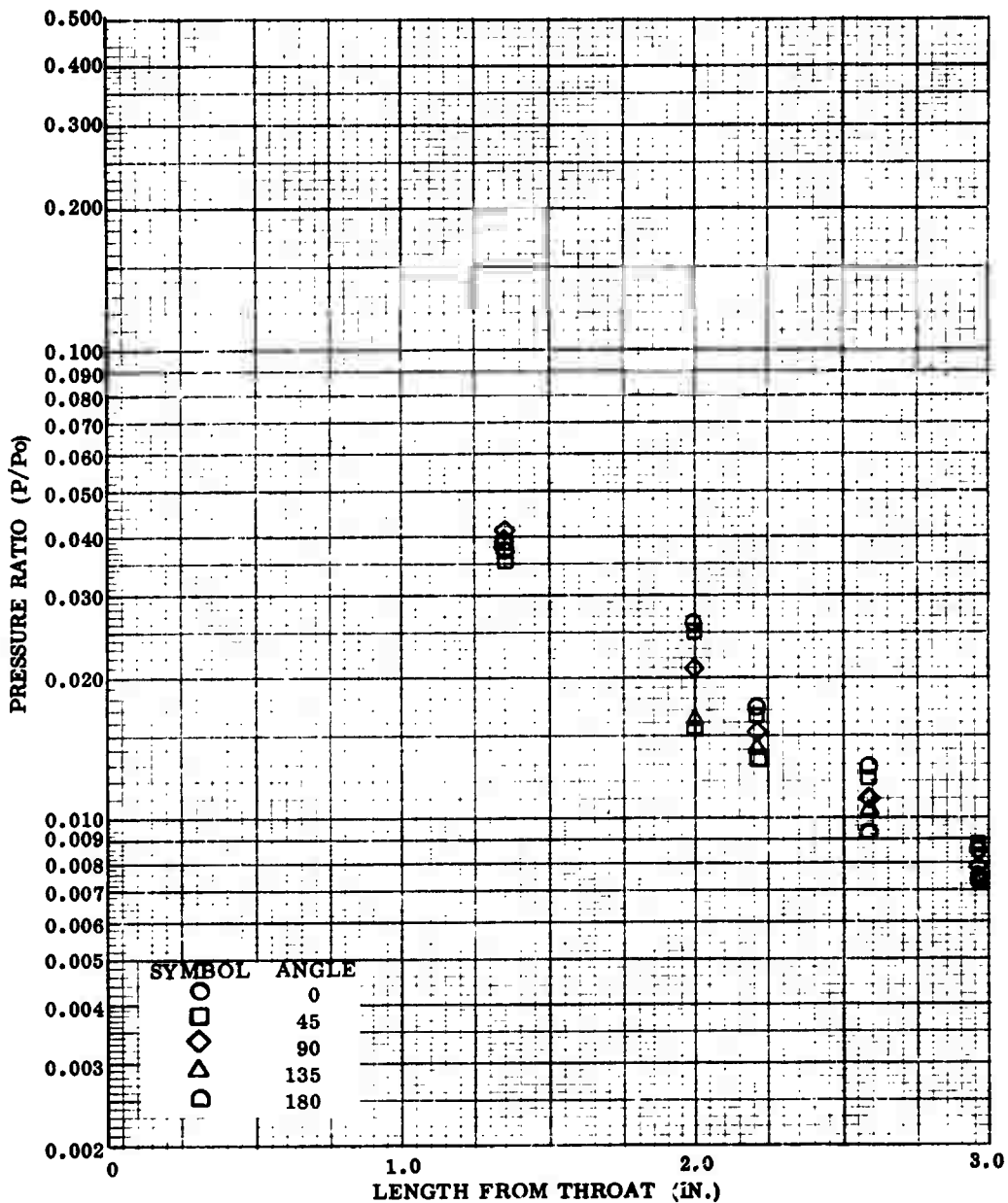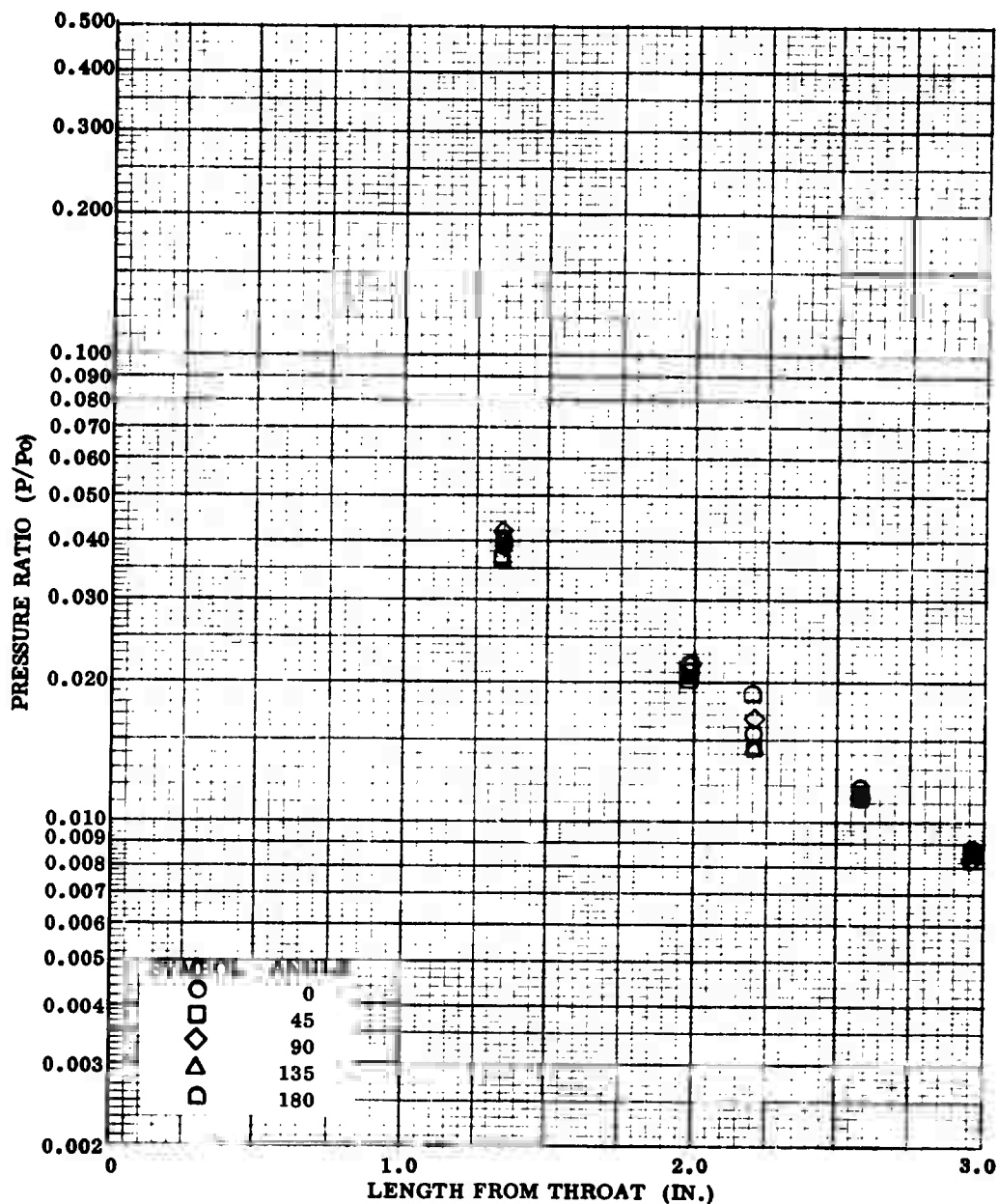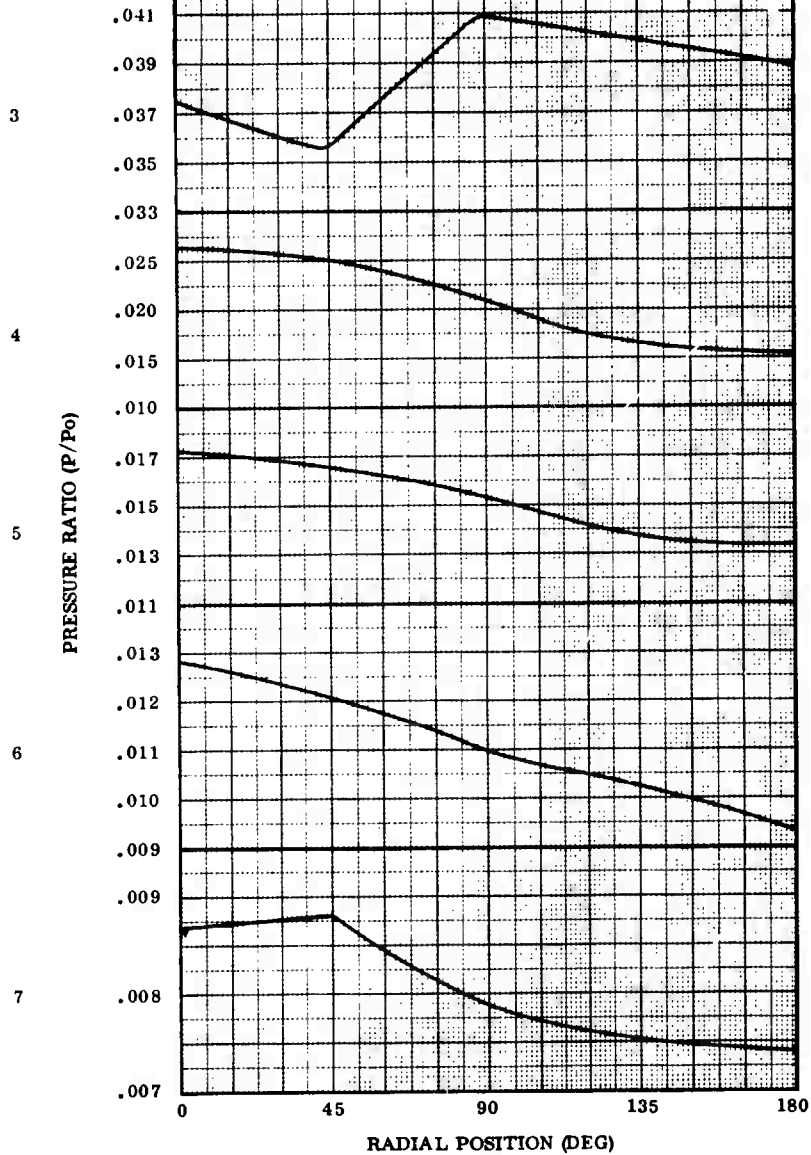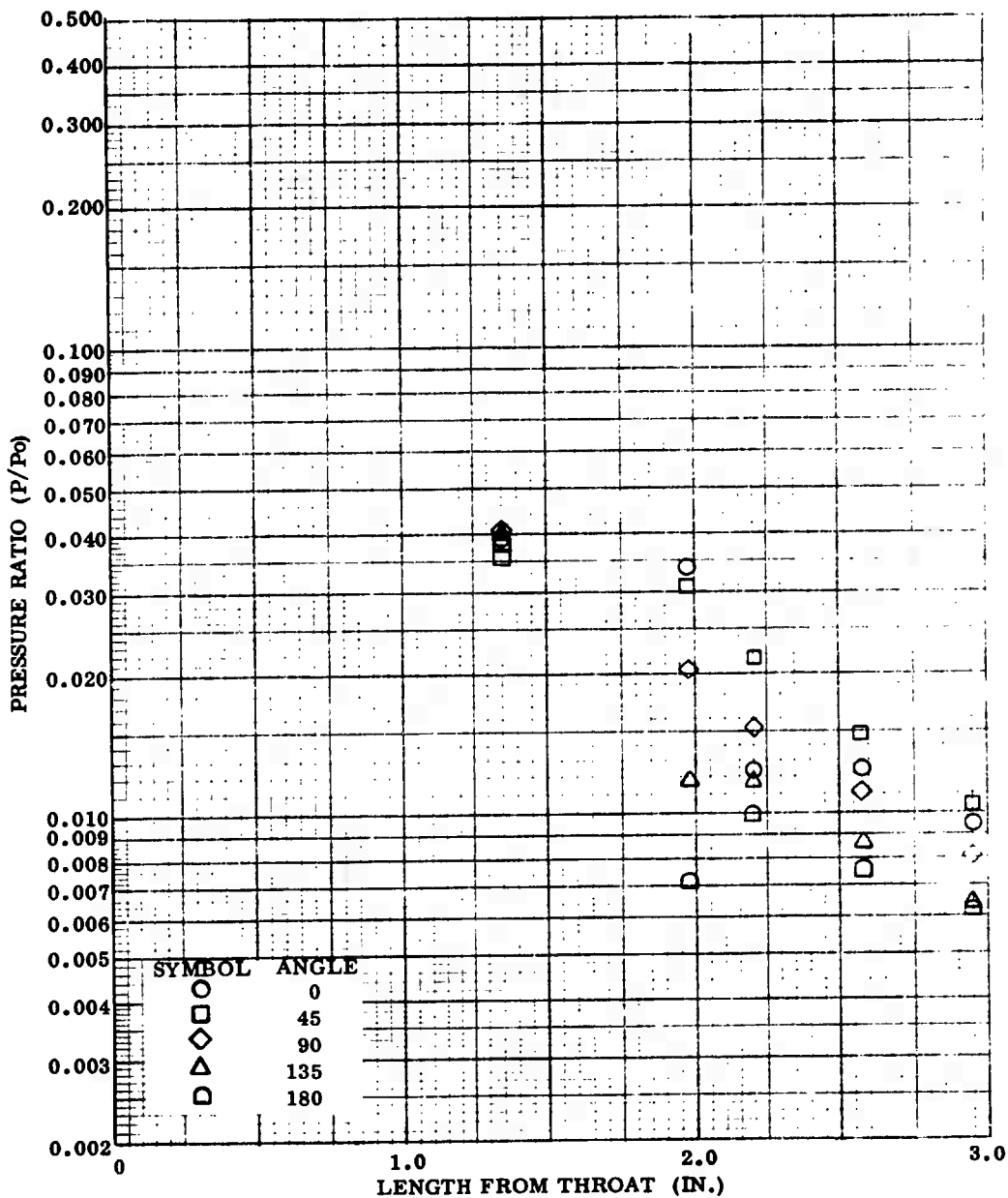
Flex-X Cold Flow Run No. 10 , Vector Angle   0   Degrees
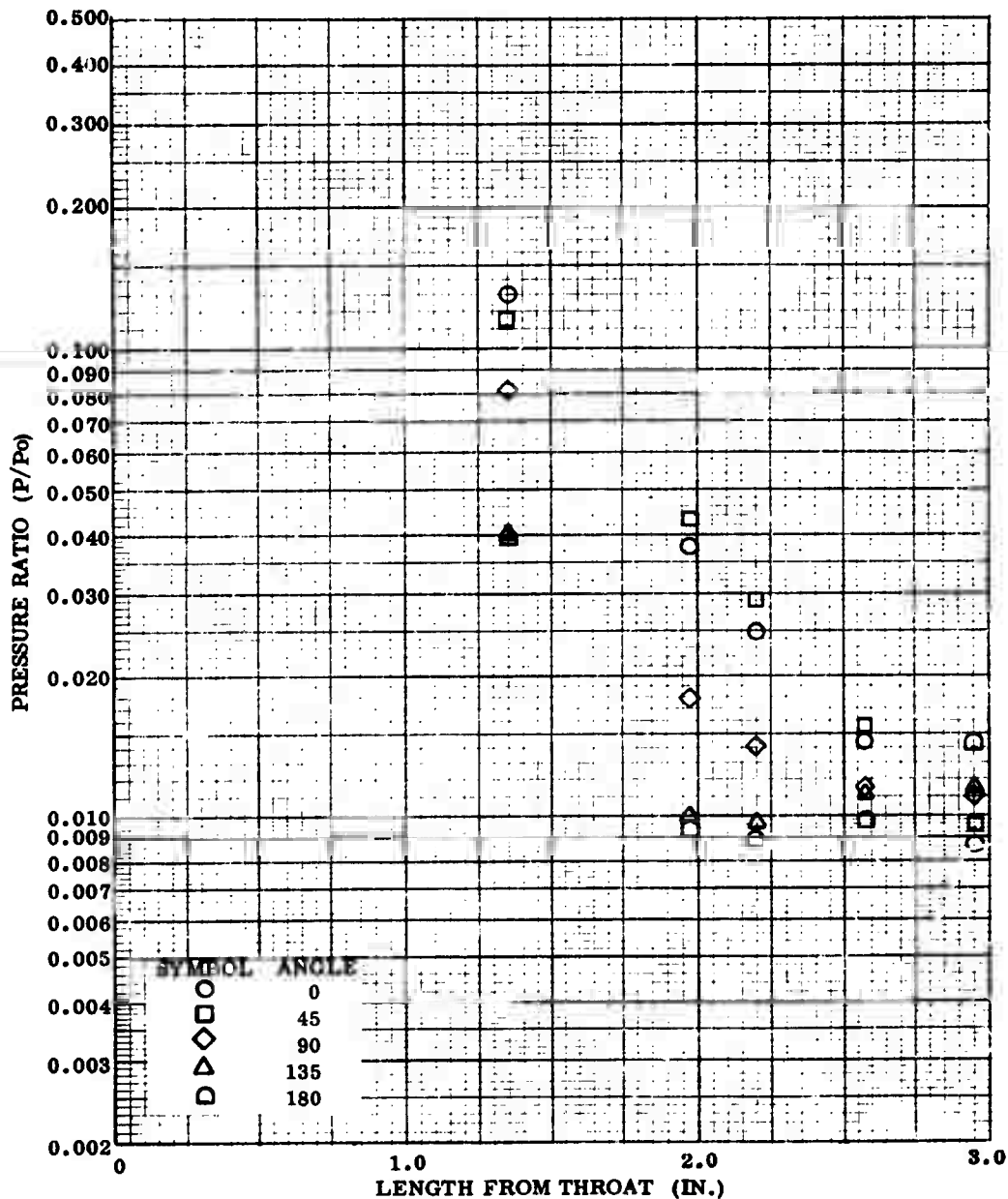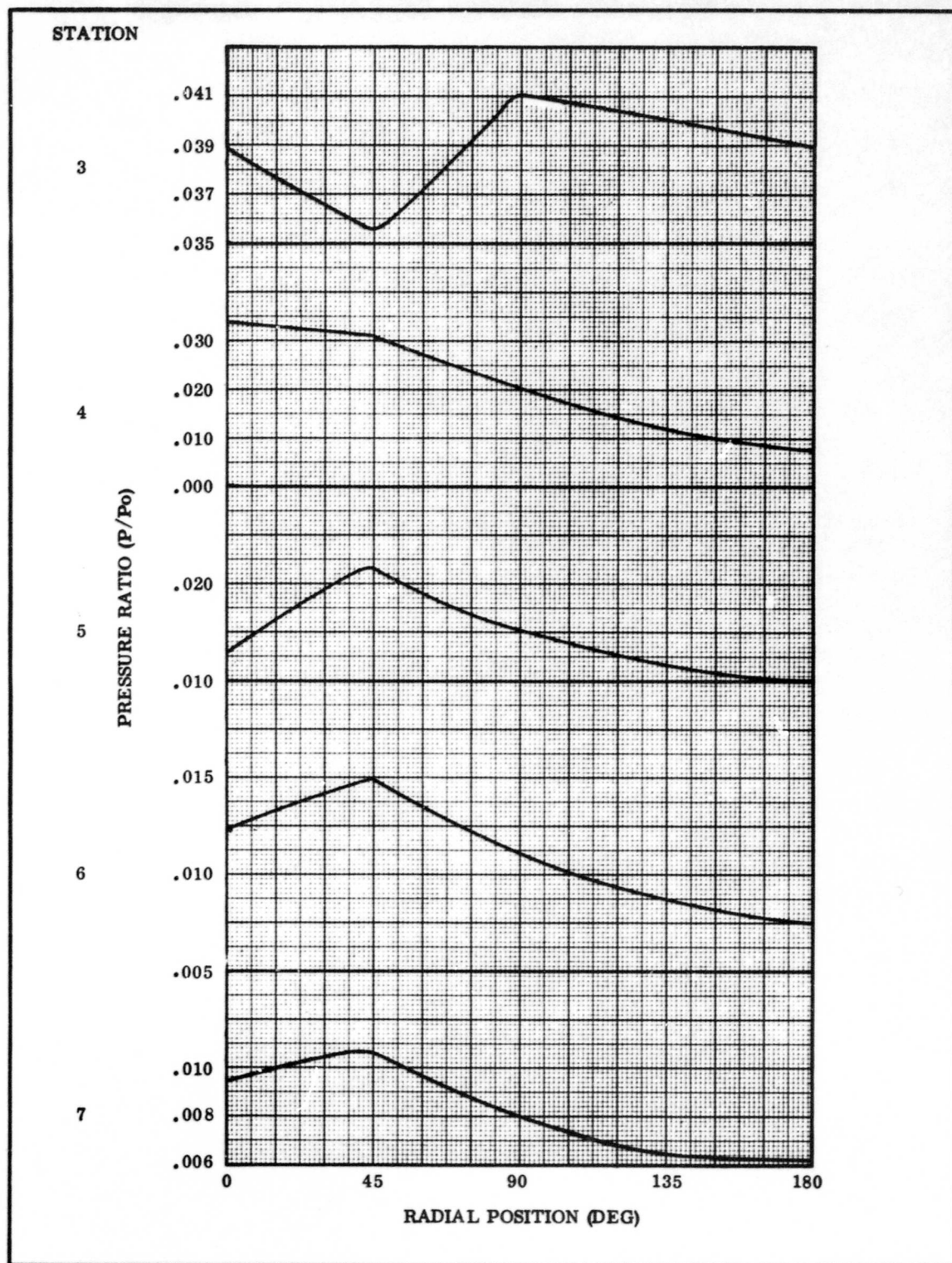
Flex-X Cold Flow Run No. 10 , Vector Angle 2.5 Degrees

Flex-X Cold Flow Run No. 10, Vector Angle 5 Degrees

79

Flex-X Cold Flow Run No. 10, Vector Angle 10 Degrees

Flex-X Cold Flow Run No. 11 , Vector Angle   0   Degrees

Flex-X Cold Flow Run No. 11 , Vector Angle 2.5 Degrees

Flex-X Cold Flow Run No. 11, Vector Angle 5 Degrees
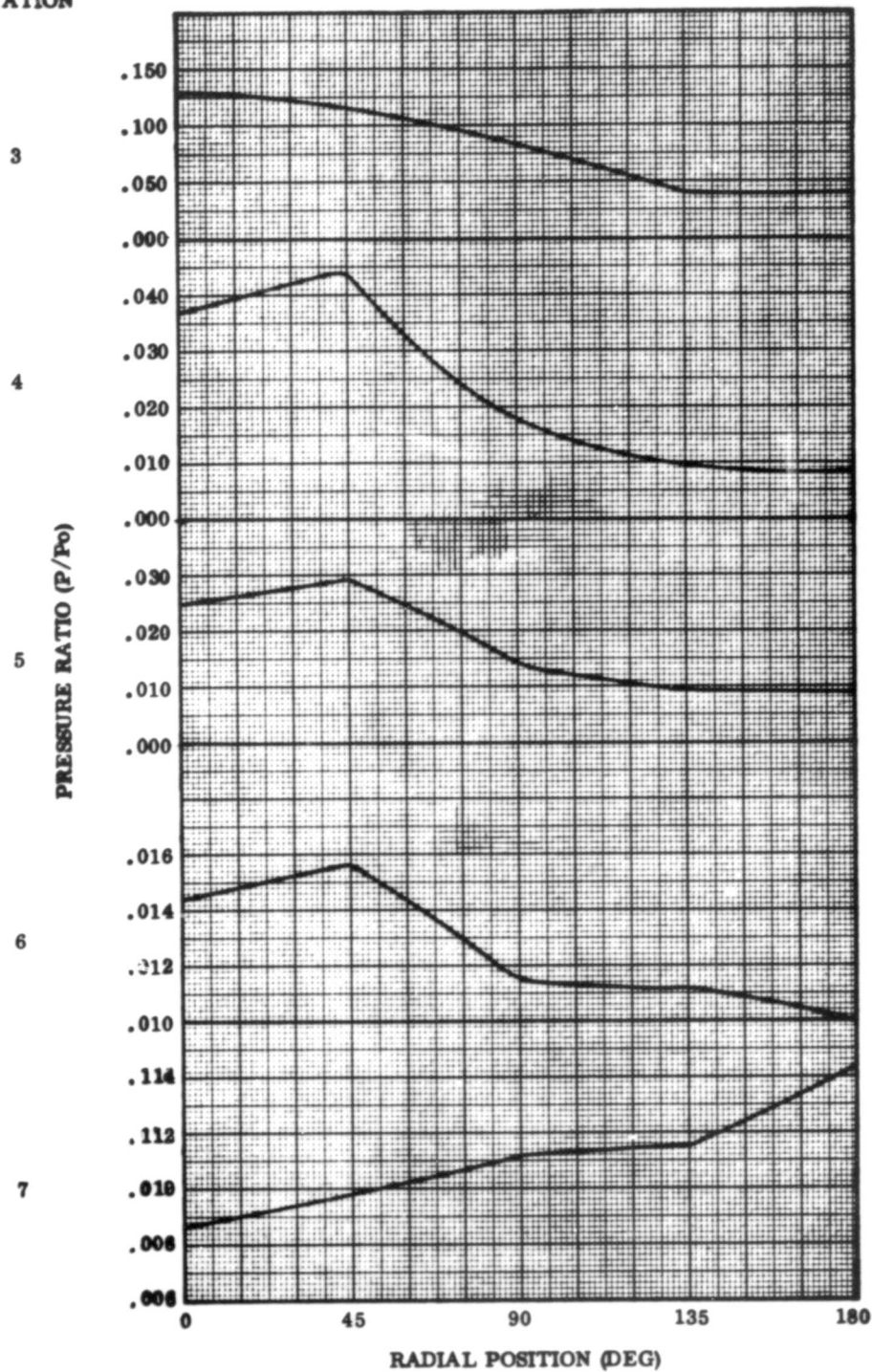
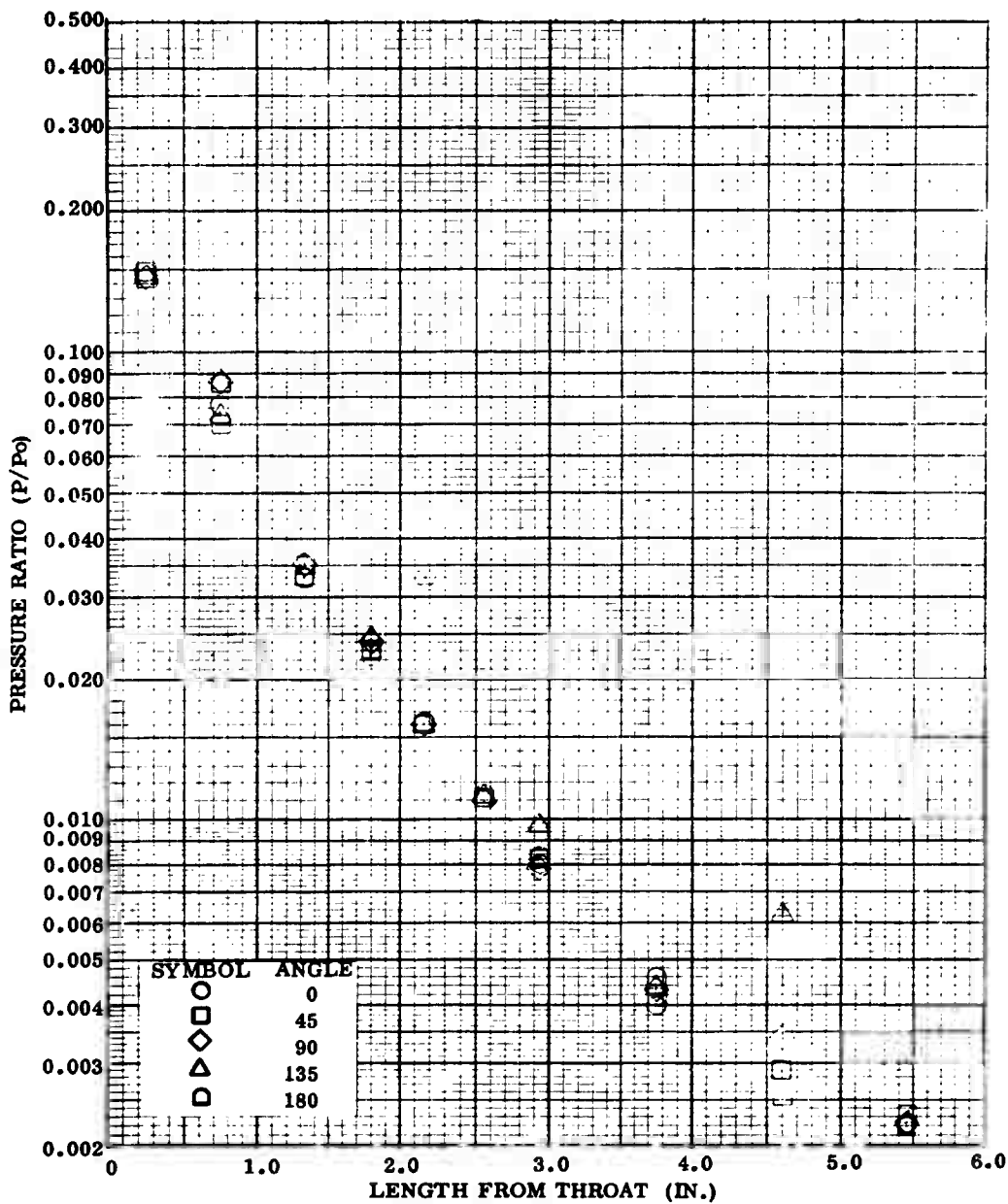Flex-X Cold Flow Run No. 11 , Vector Angle 10 Degrees

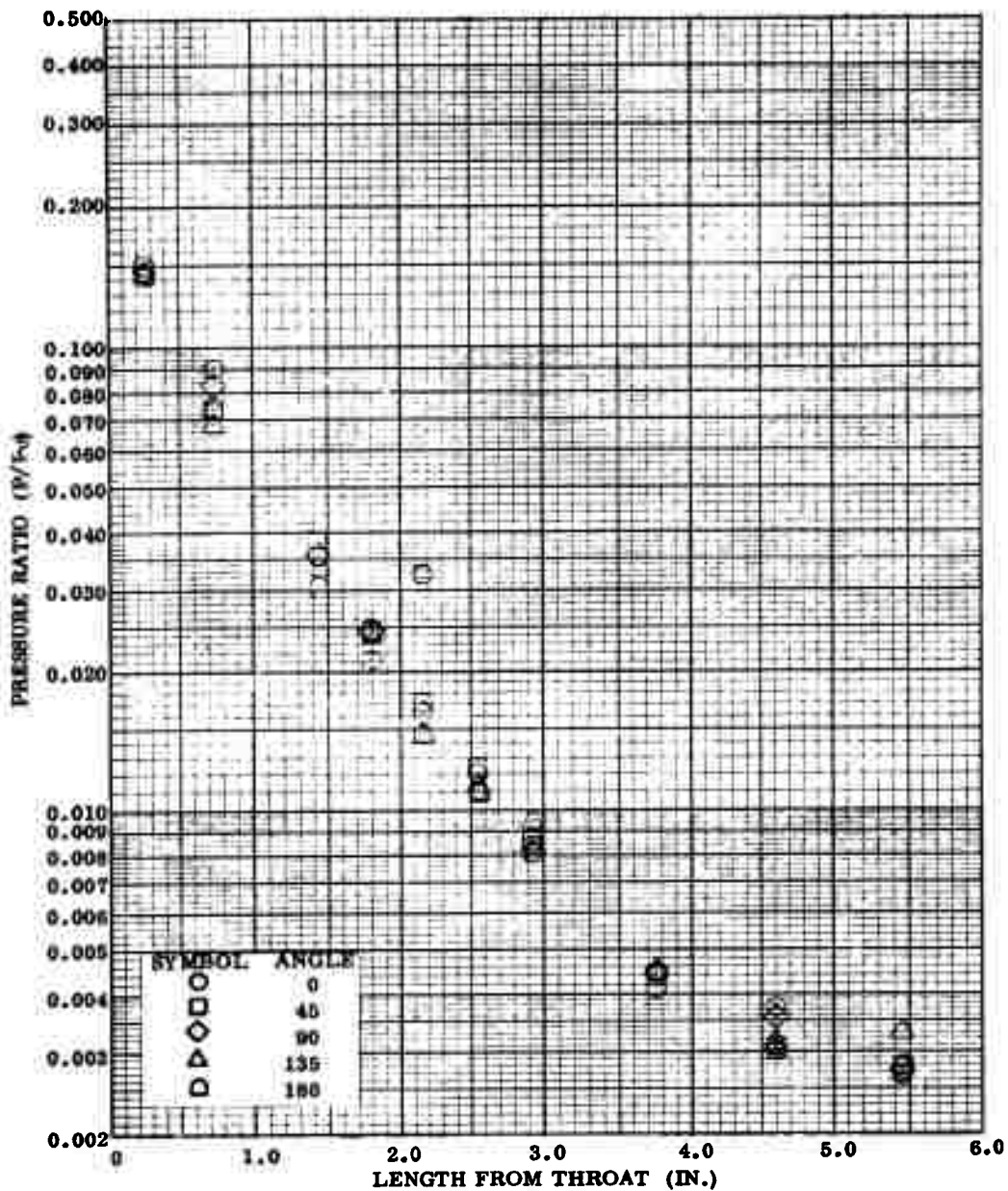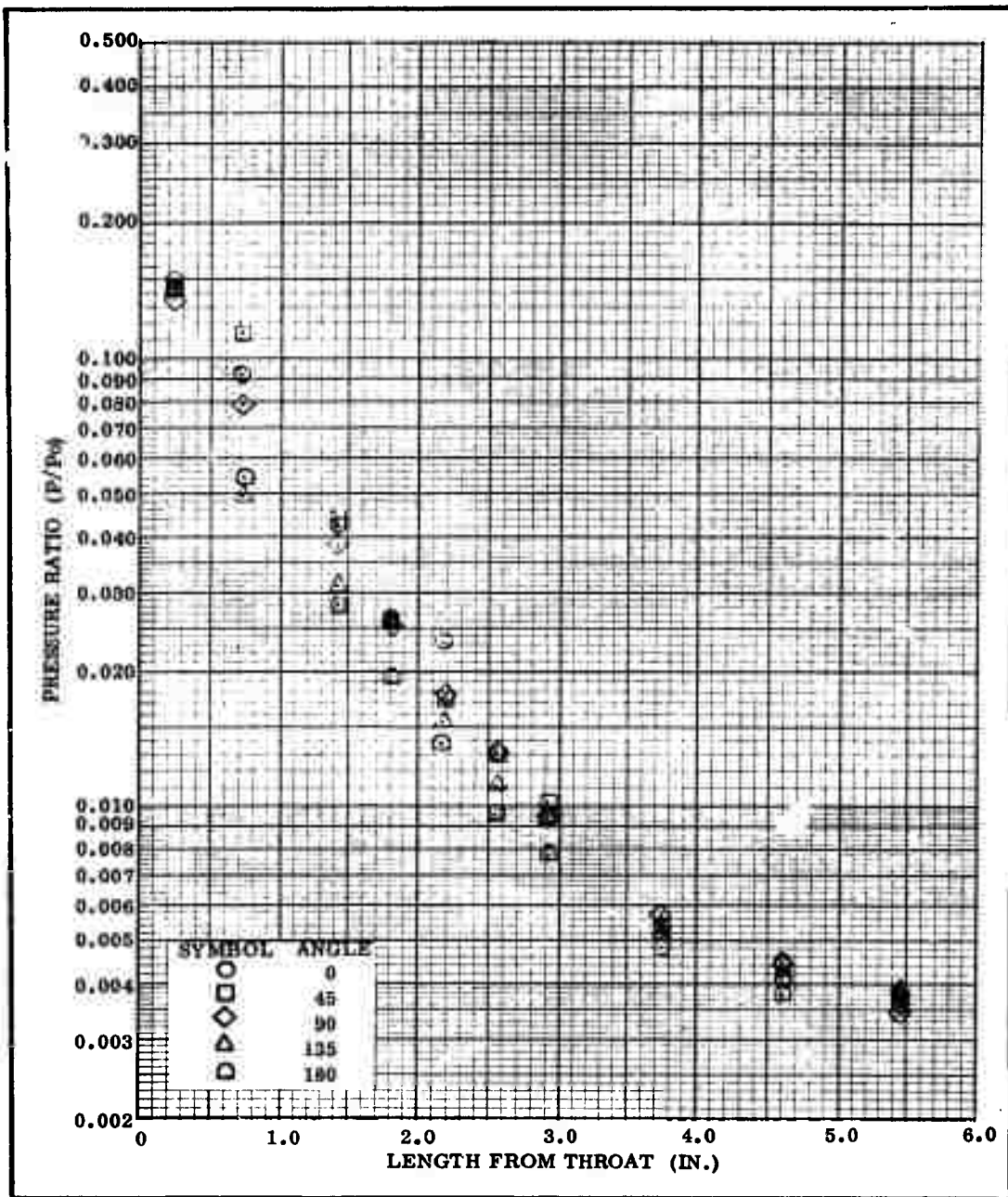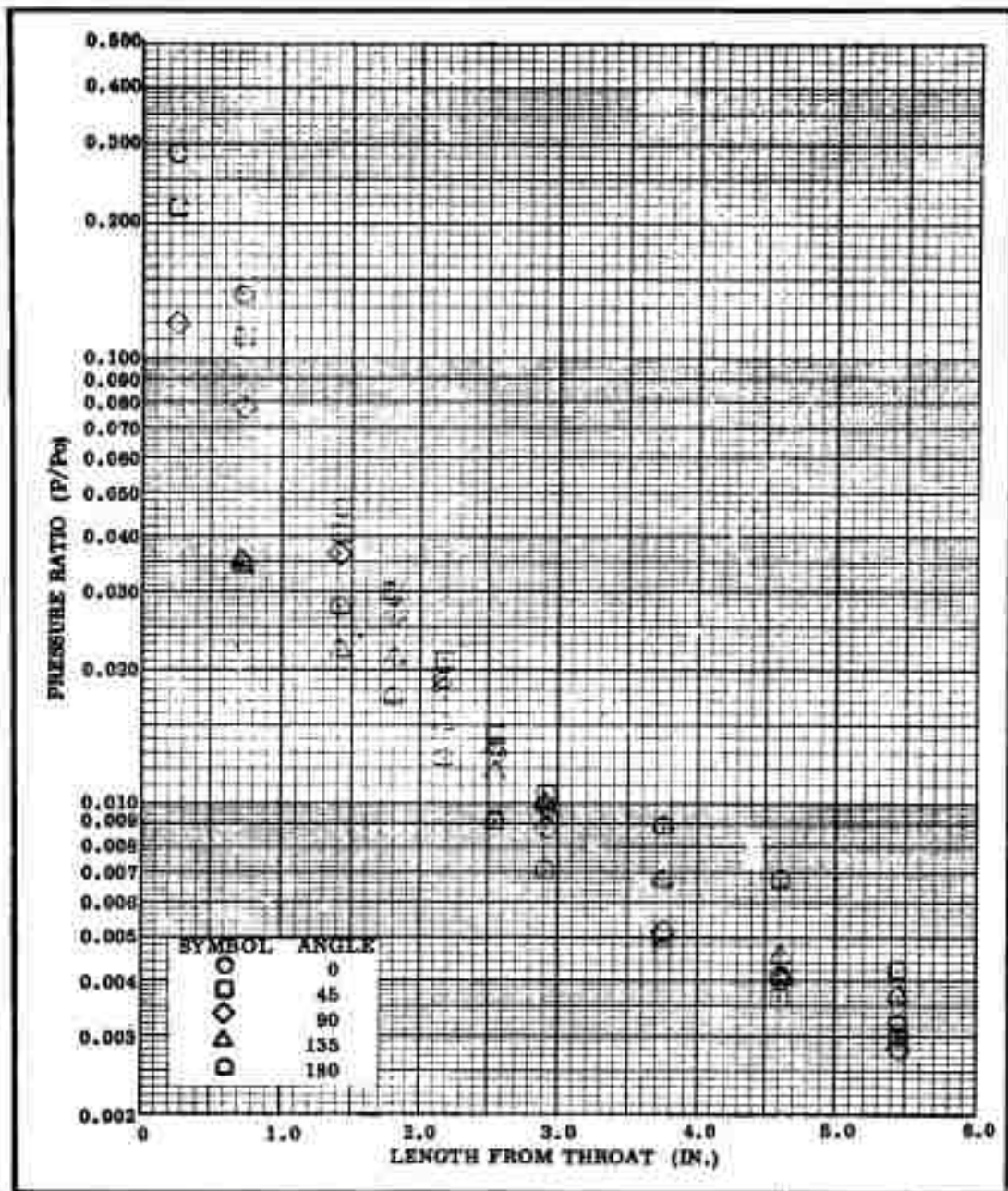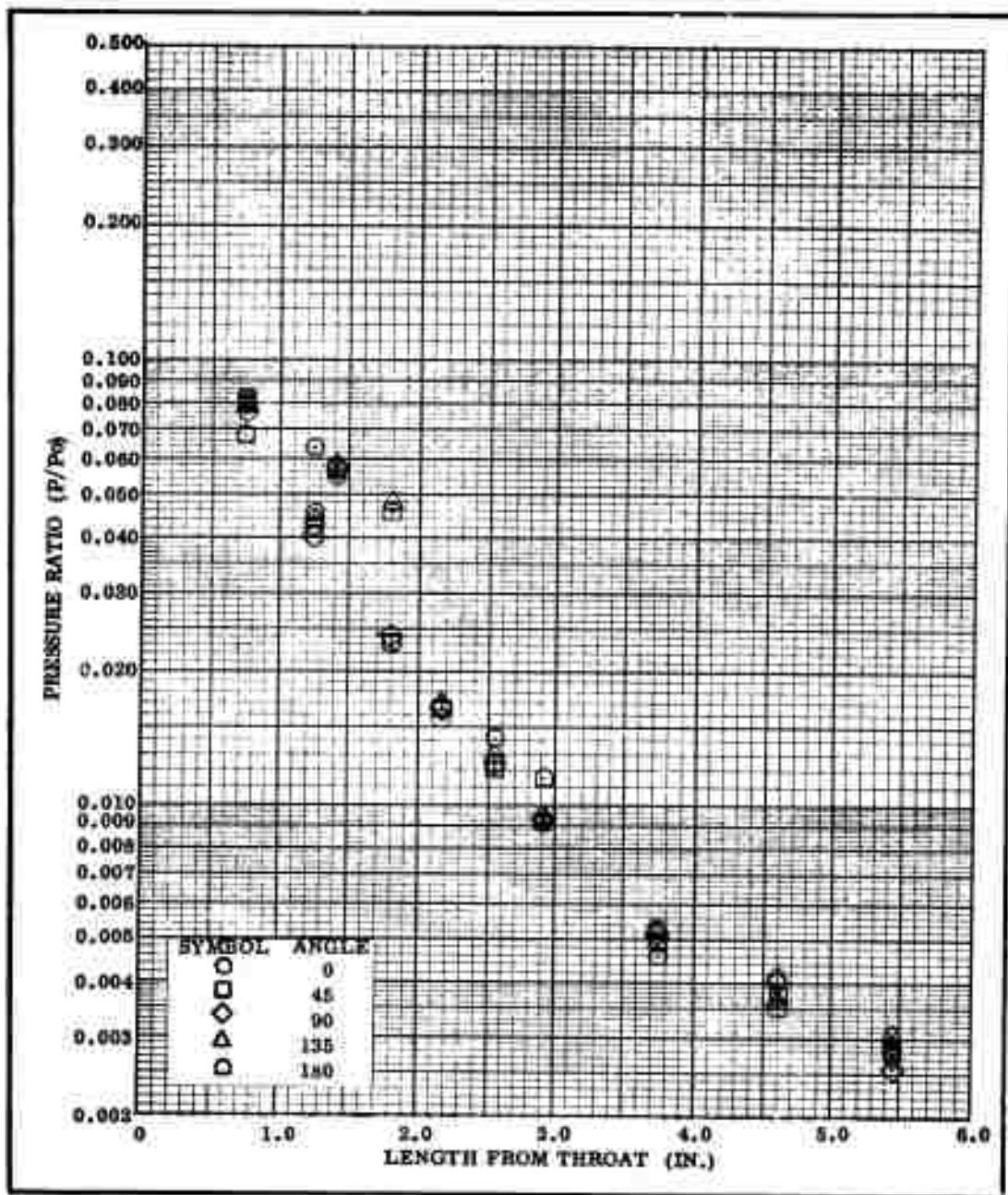Flex-X Cold Flow Run No. 12, Vector Angle   0 Degrees

Flex-X Cold Flow Run No. 12, Vector Angle 2.5 Degrees

Flex-X Cold Flow Run No. 12 , Vector Angle 5   Degrees

Flex-X Cold Flow Run No. 12, Vector Angle 10 Degrees

88

Flex-X Cold Flow Run No. 13 , Vector Angle 0 Degrees

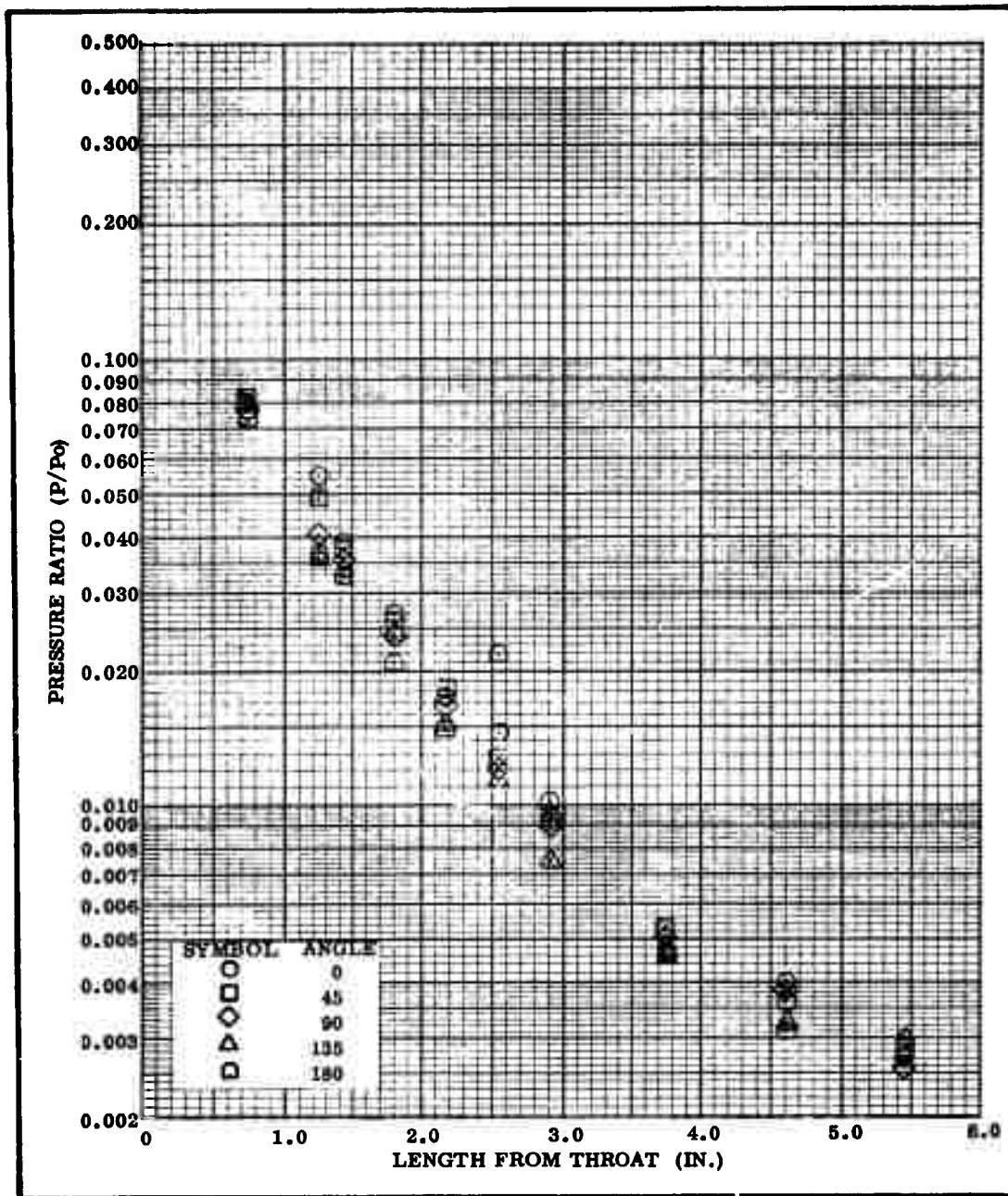Flex-X Cold Flow Run No. 13 , Vector Angle 2.5 Degrees

Flex-X Cold Flow Run No. 13 , Vector Angle 5 Degrees
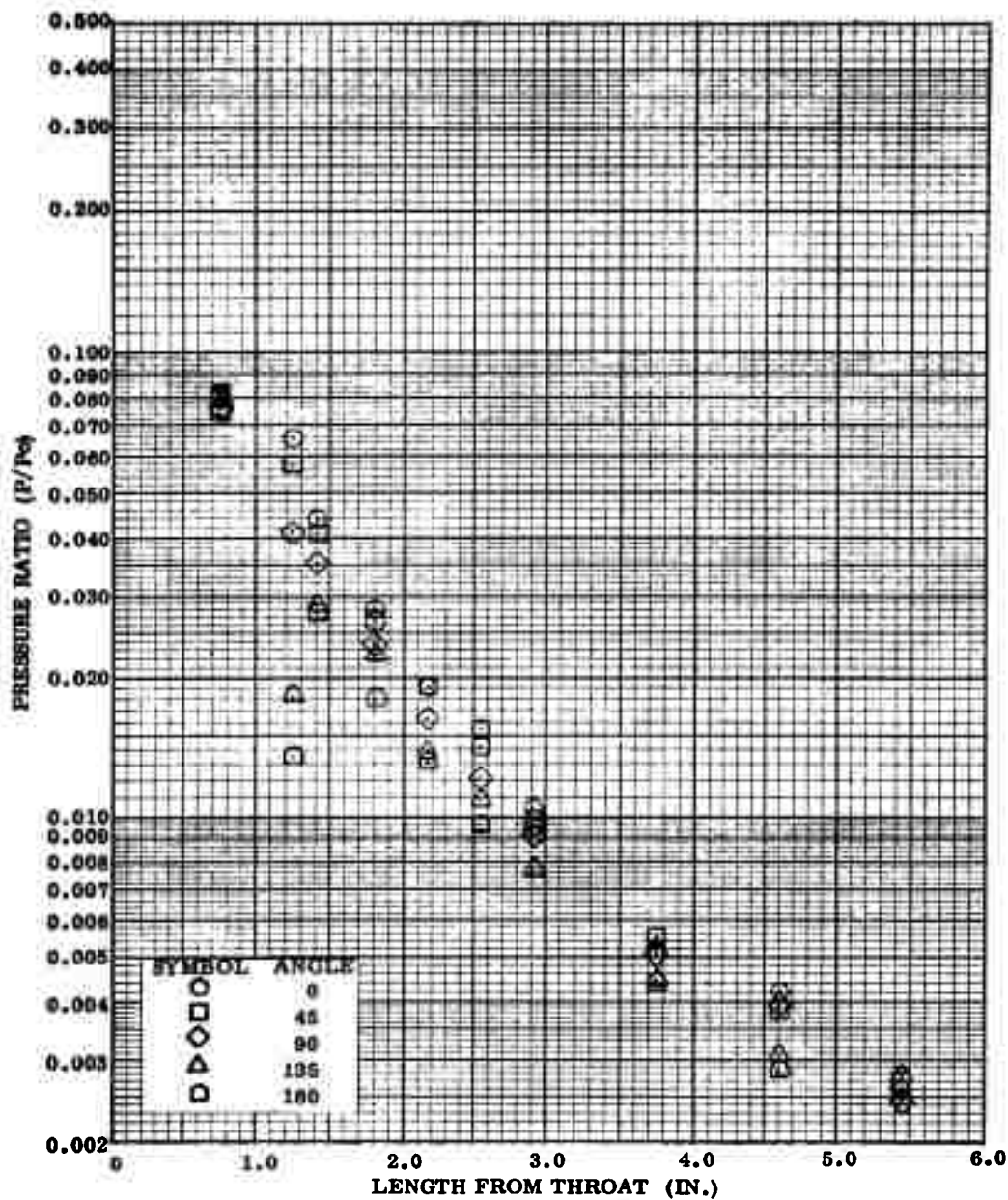
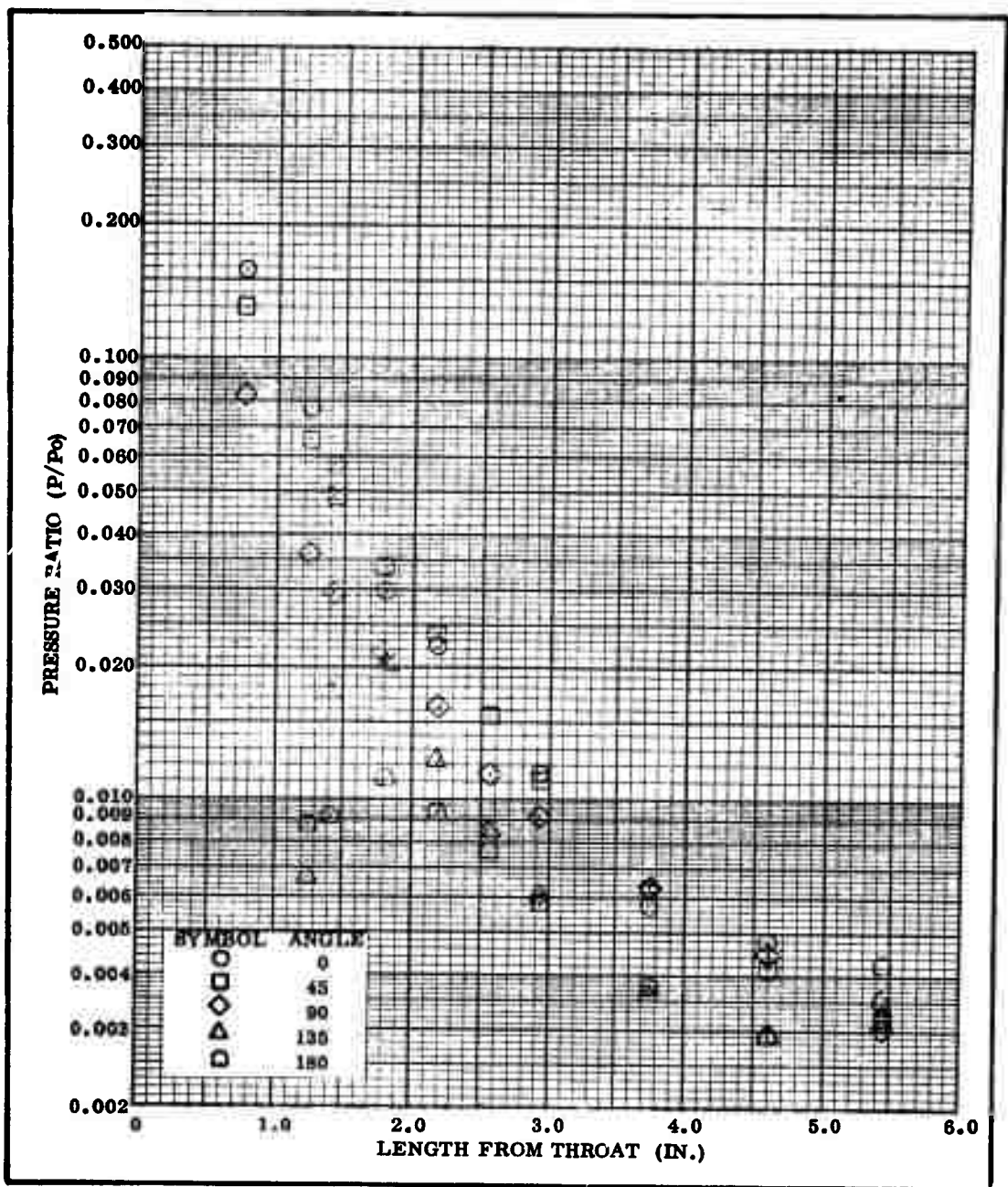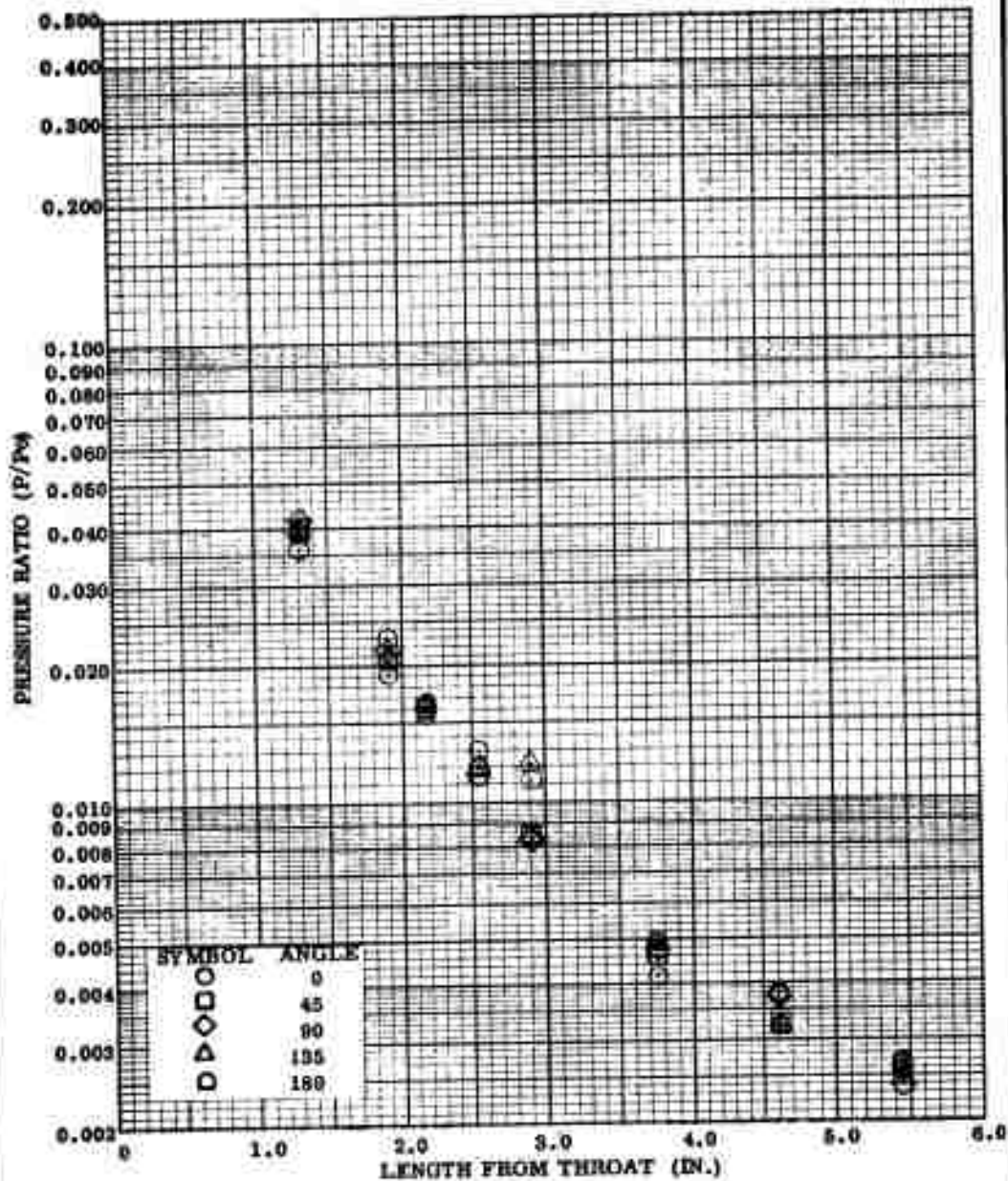Flex-X Cold Flow Run No. 13 , Vector Angle   10 Degrees

Flex-X Cold Flow Run No. 14 , Vector Angle 0   Degrees

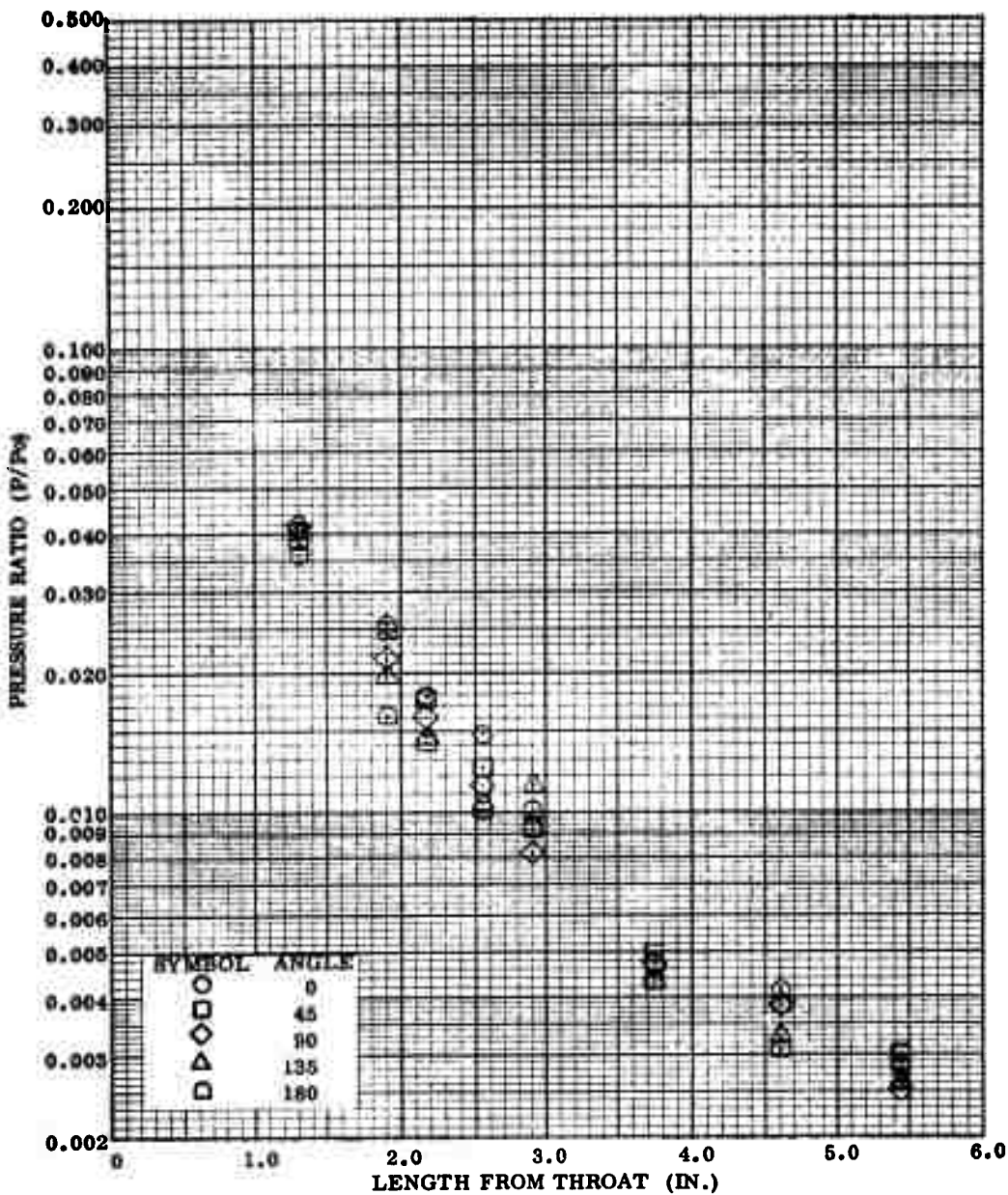Flex-X Cold Flow Run No. 14 , Vector Angle 2.5 Degrees

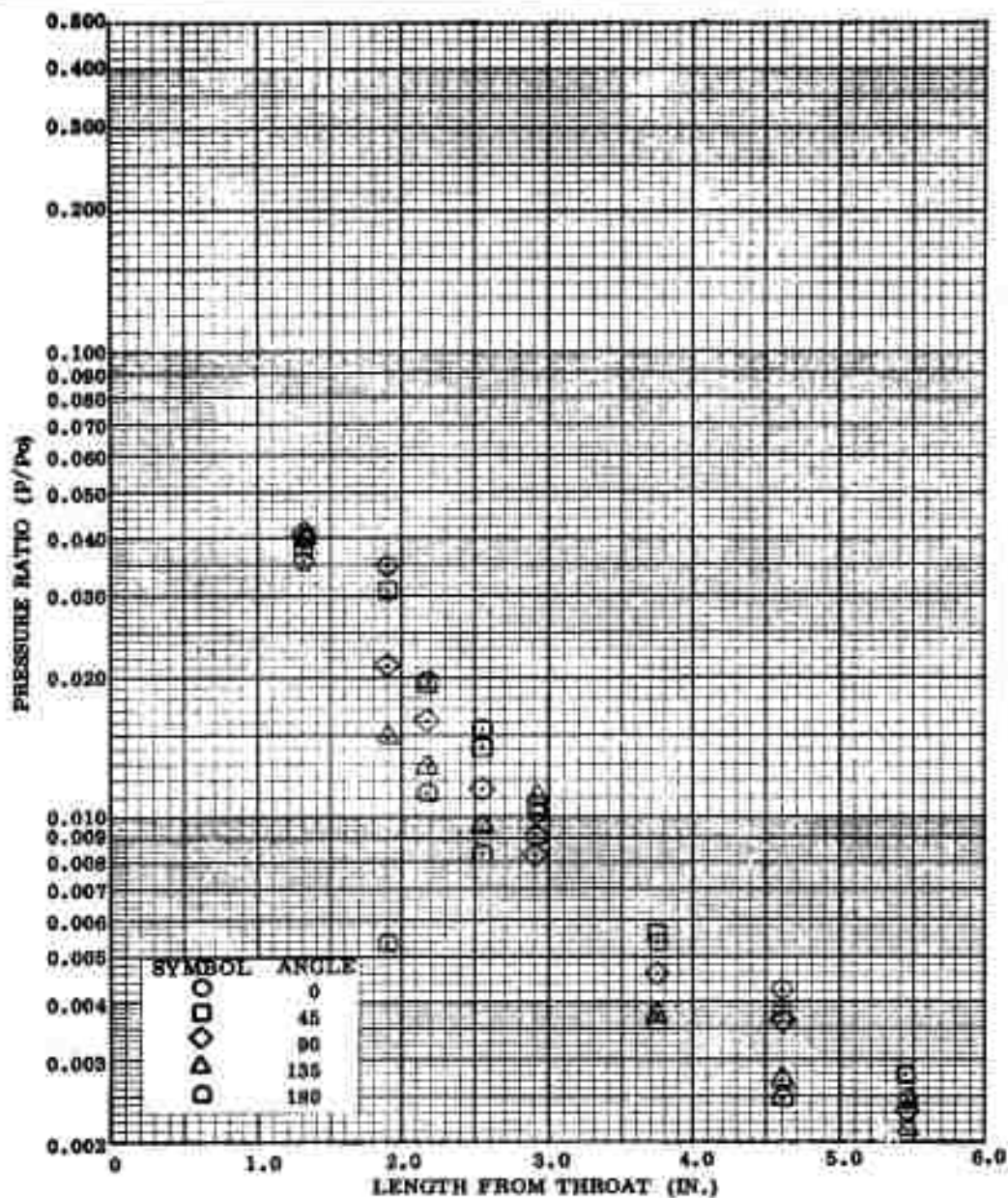Flex-X Cold Flow Run No. 14, Vector Angle 5 Degrees

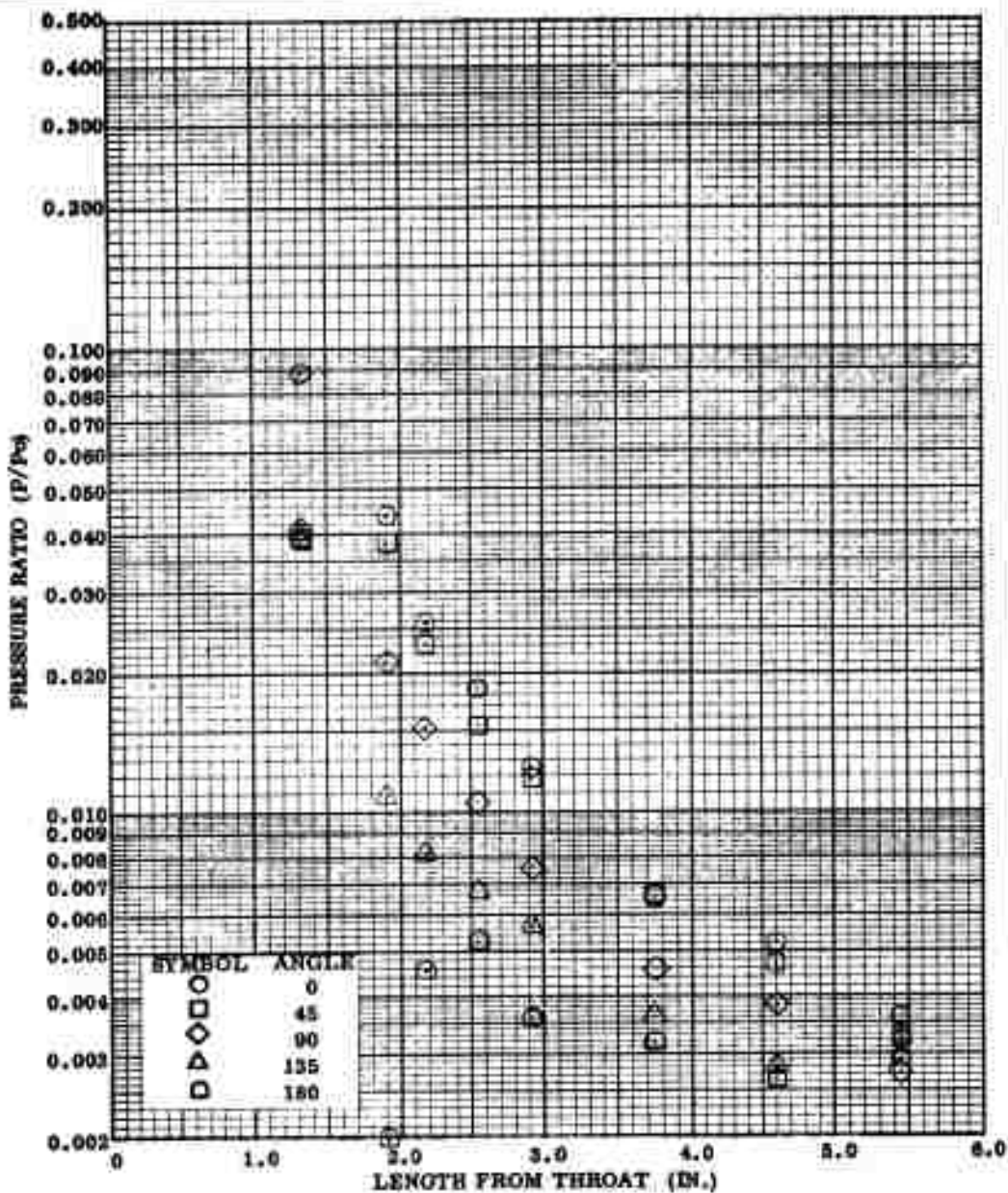Flex-X Cold Flow Run No. 14 , Vector Angle 10 Degrees

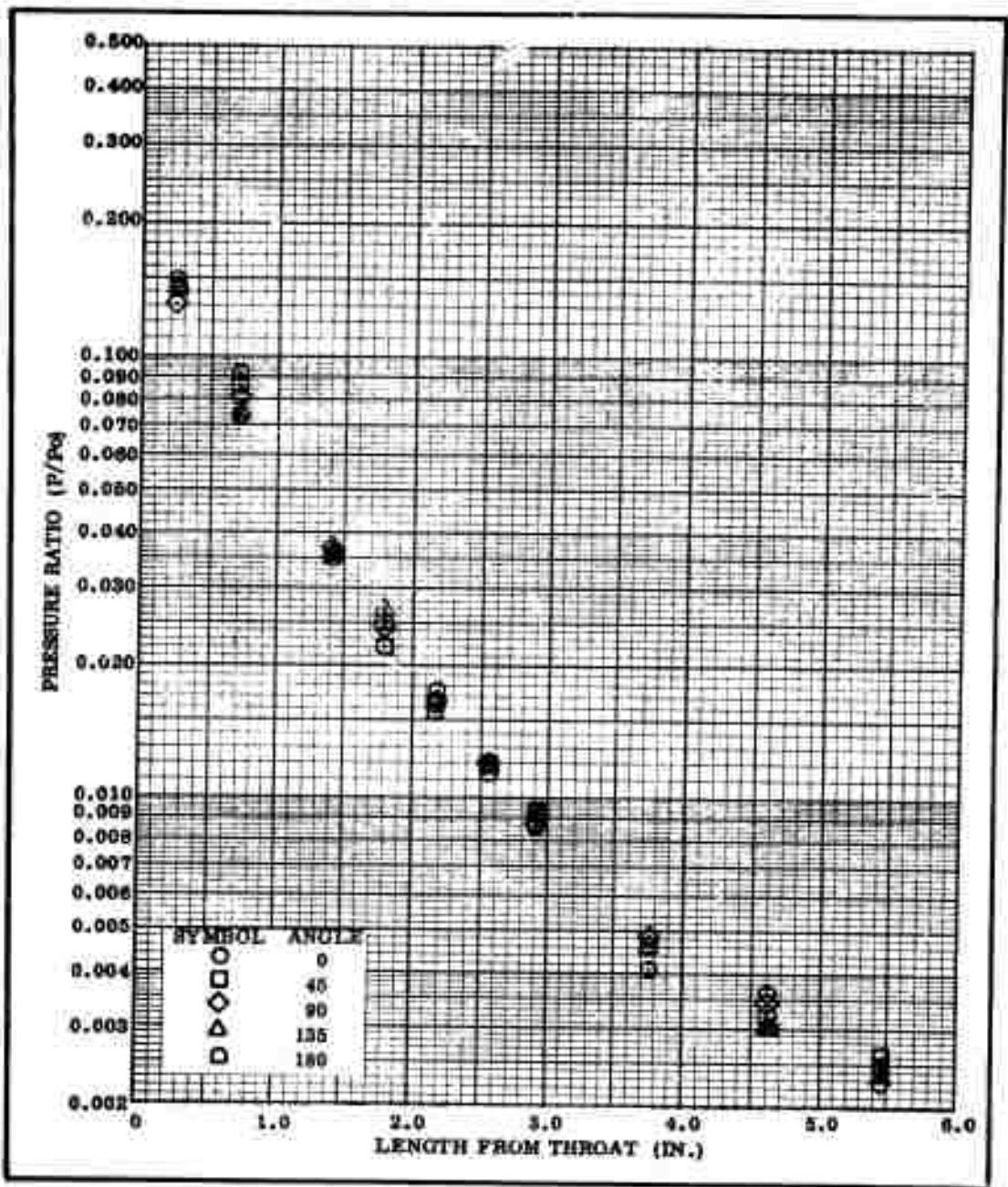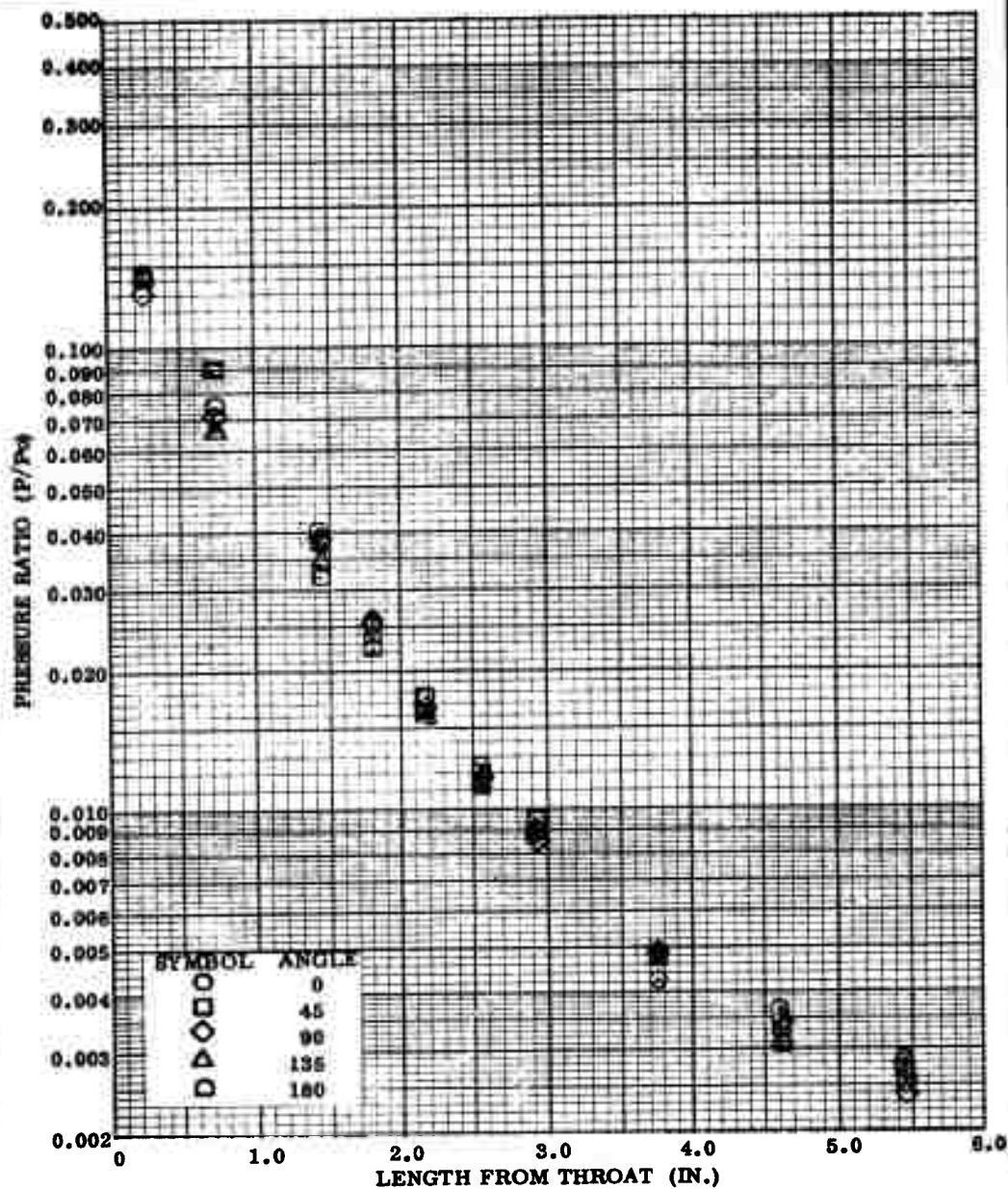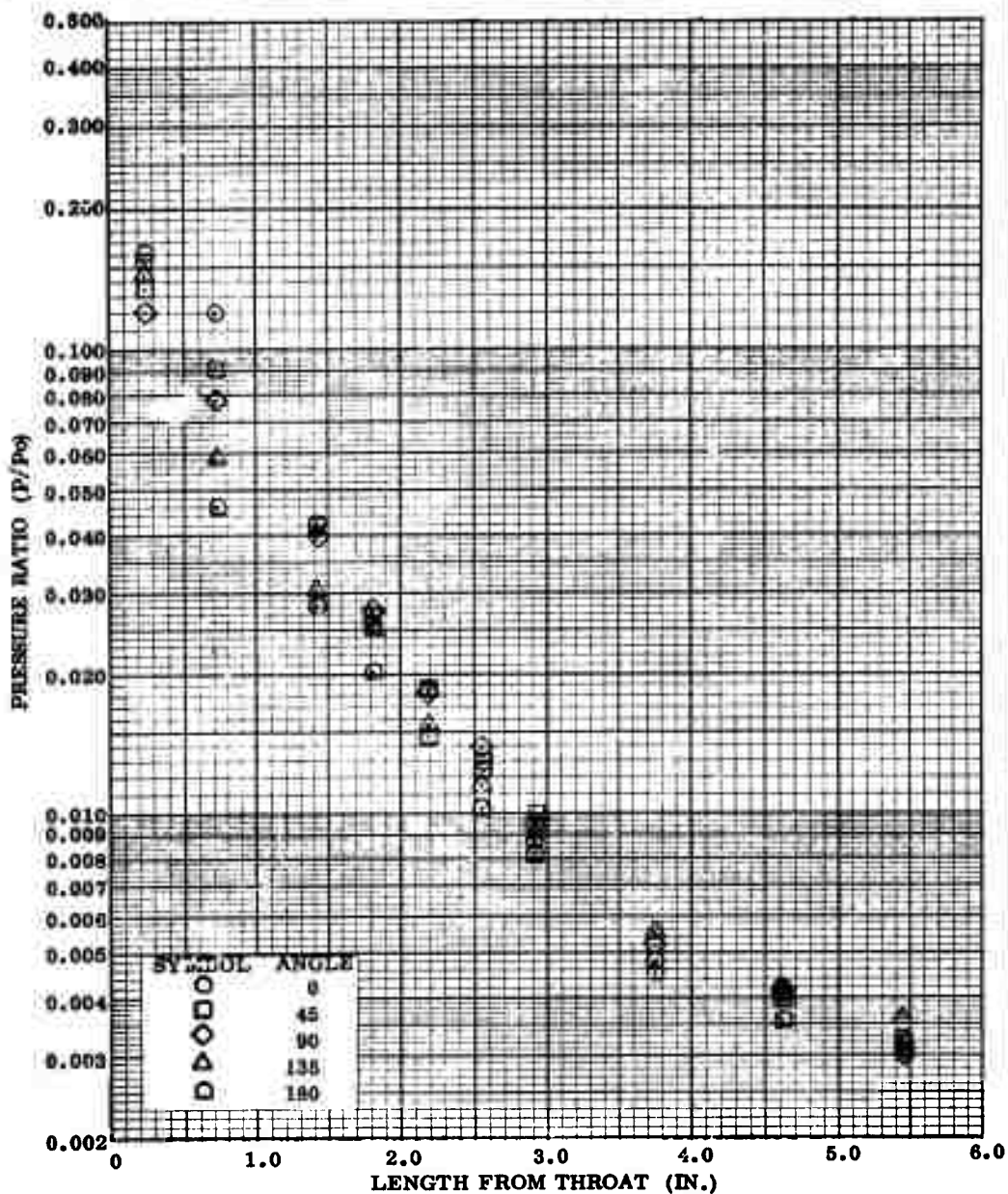Flex-X Cold Flow Run No. 15 , Vector Angle 0 Degrees

Flex-X Cold Flow Run No. 15, Vector Angle 2.5 Degrees

Flex-X Cold Flow Run No. 15 , Vector Angle 5 Degrees

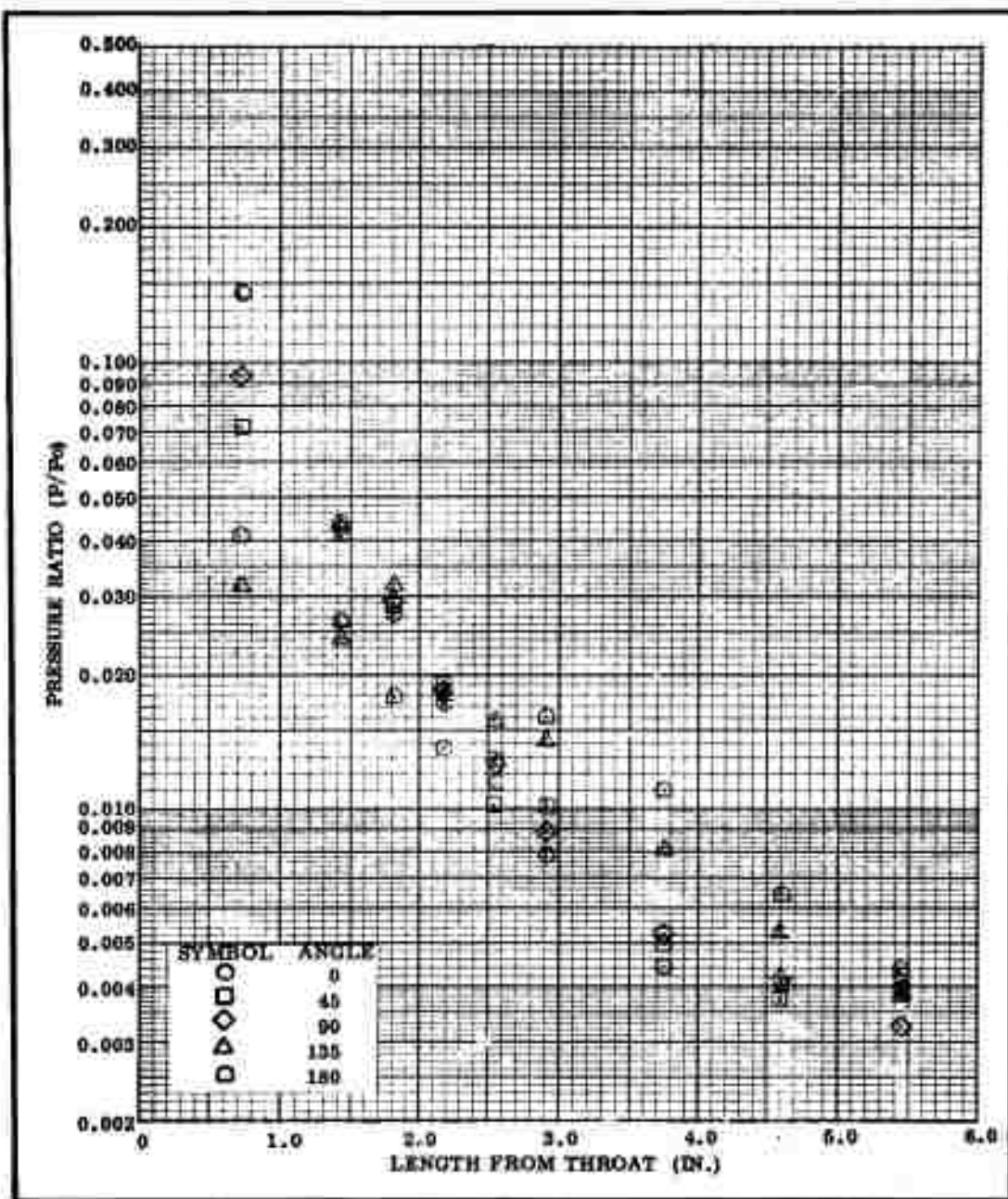Flex-X Cold Flow Run No. 15, Vector Angle 10 Degrees

100

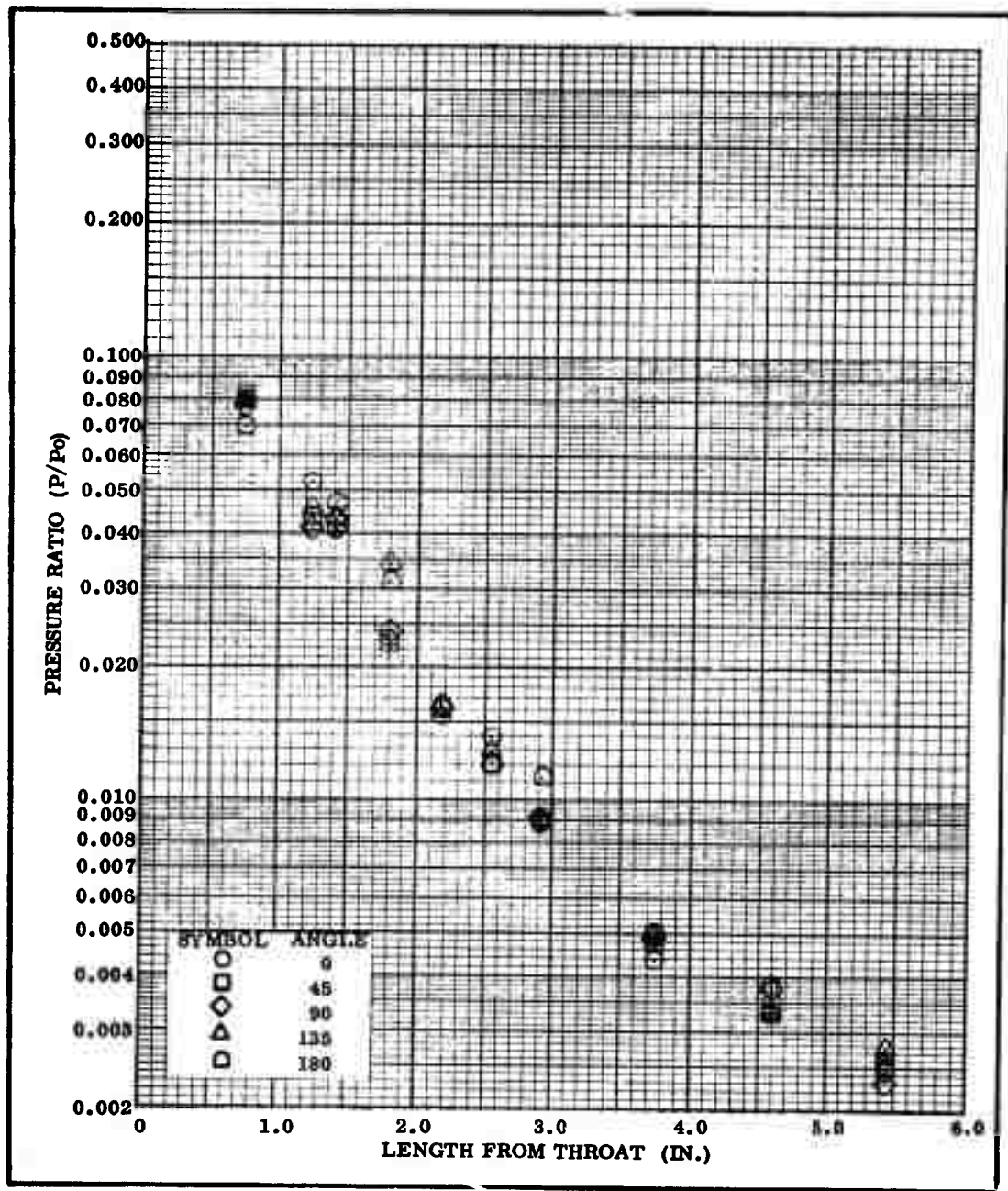Flex-X Cold Flow Run No. 16, Vector Angle 0 Degrees

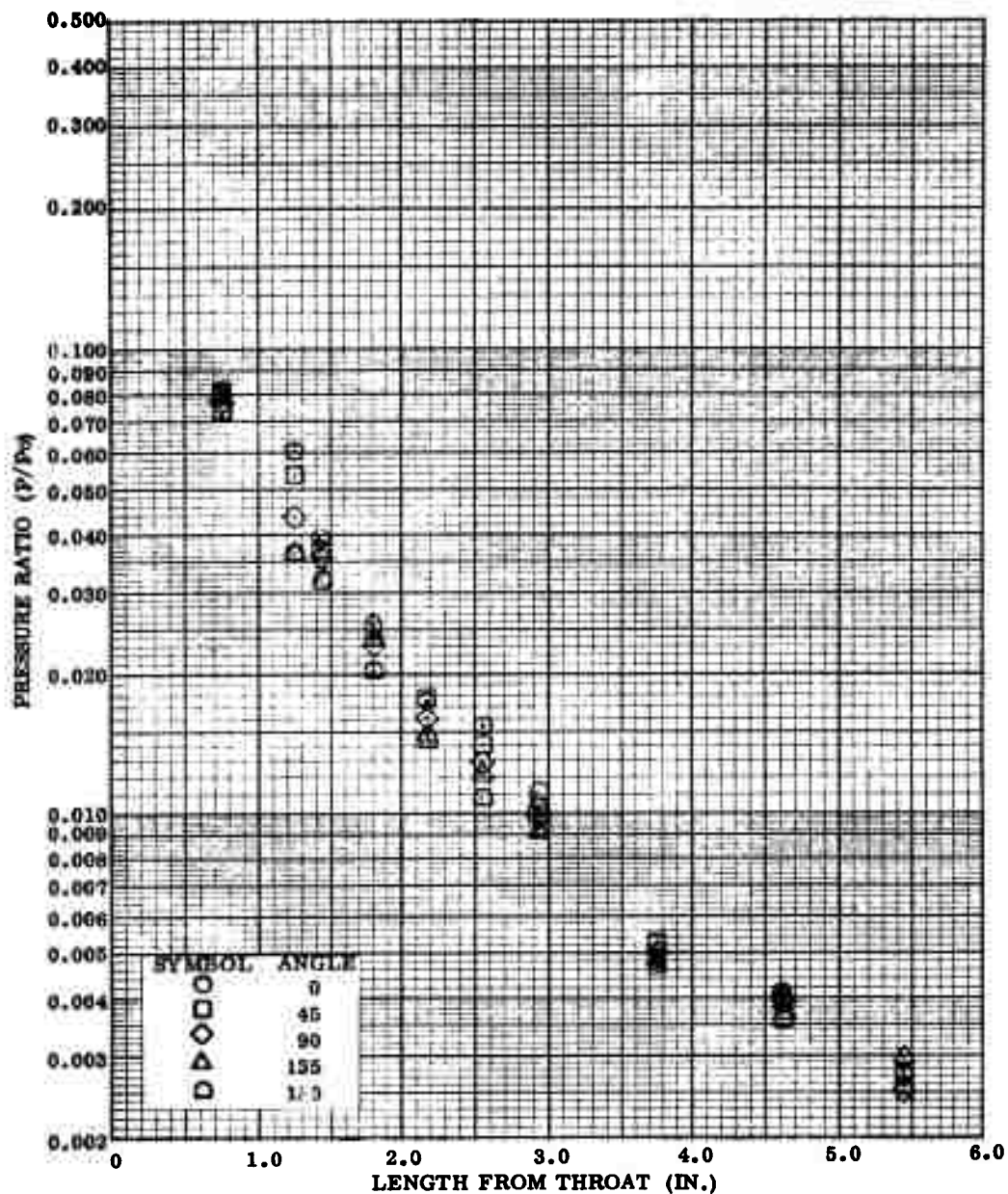Flex-X Cold Flow Run No. 16 , Vector Angle 2.5 Degrees

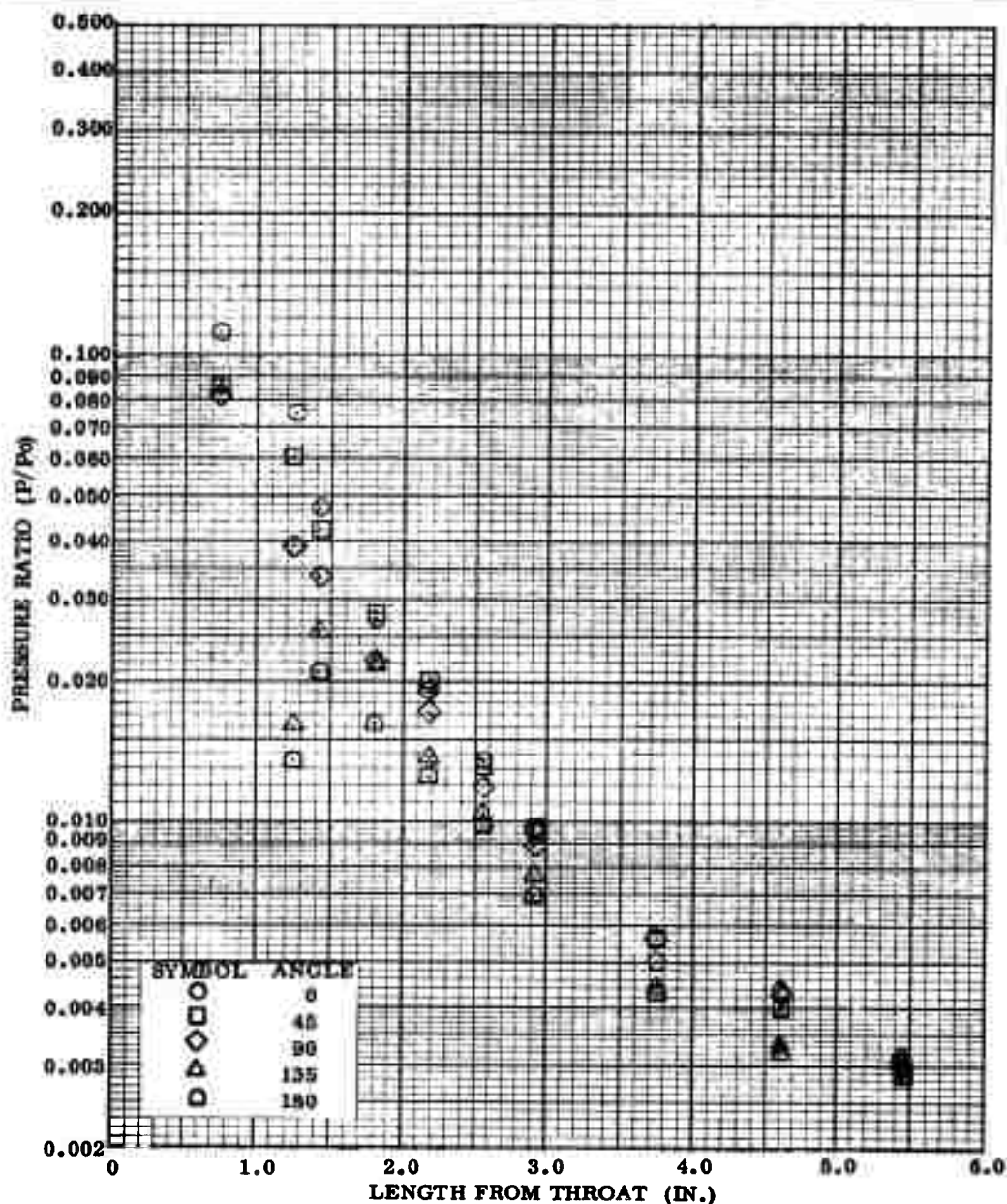Flex-X Cold Flow Run No. 16 , Vector Angle 5 Degrees

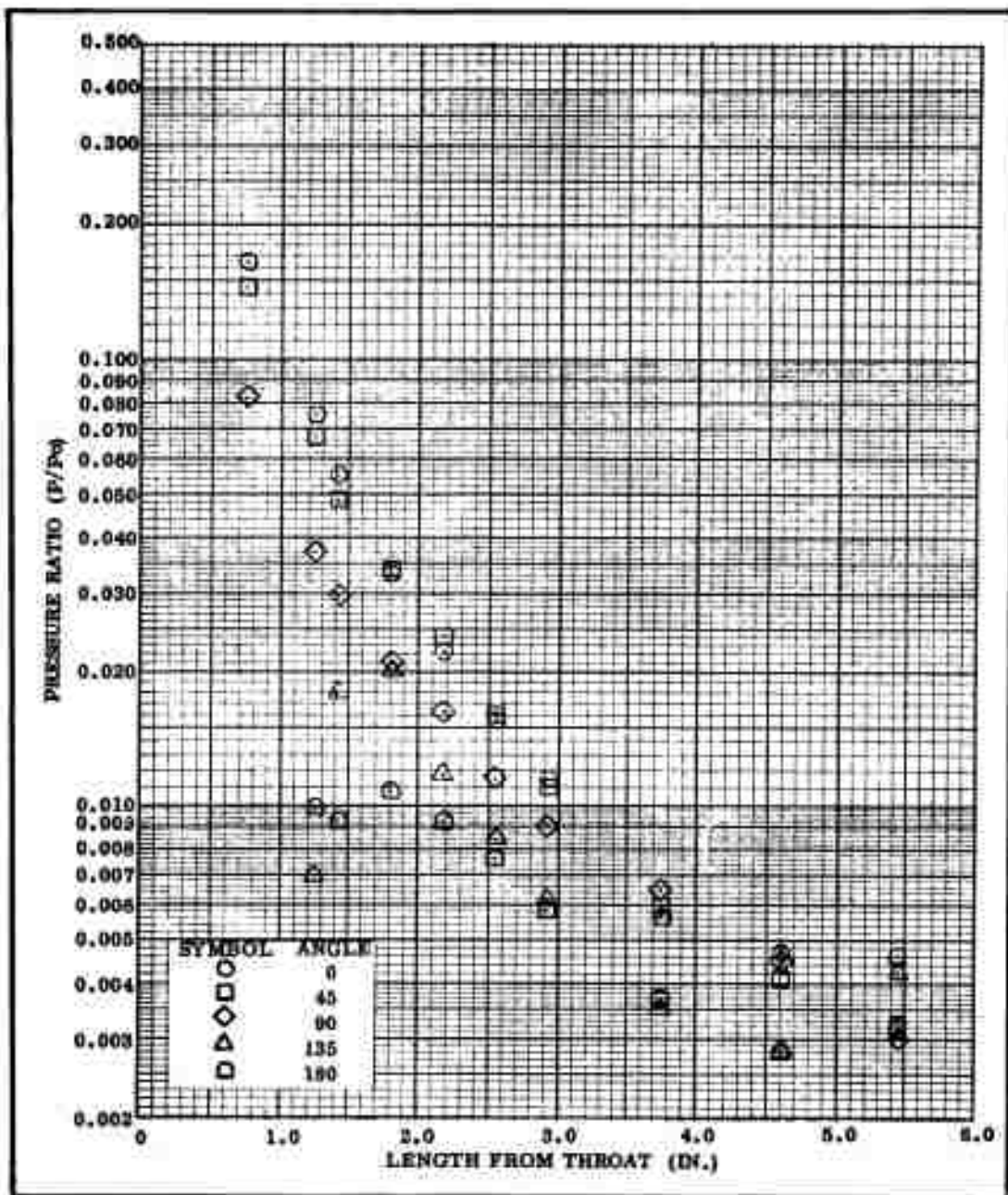Flex-X Cold Flow Run No. 16 , Vector Angle 10 Degrees

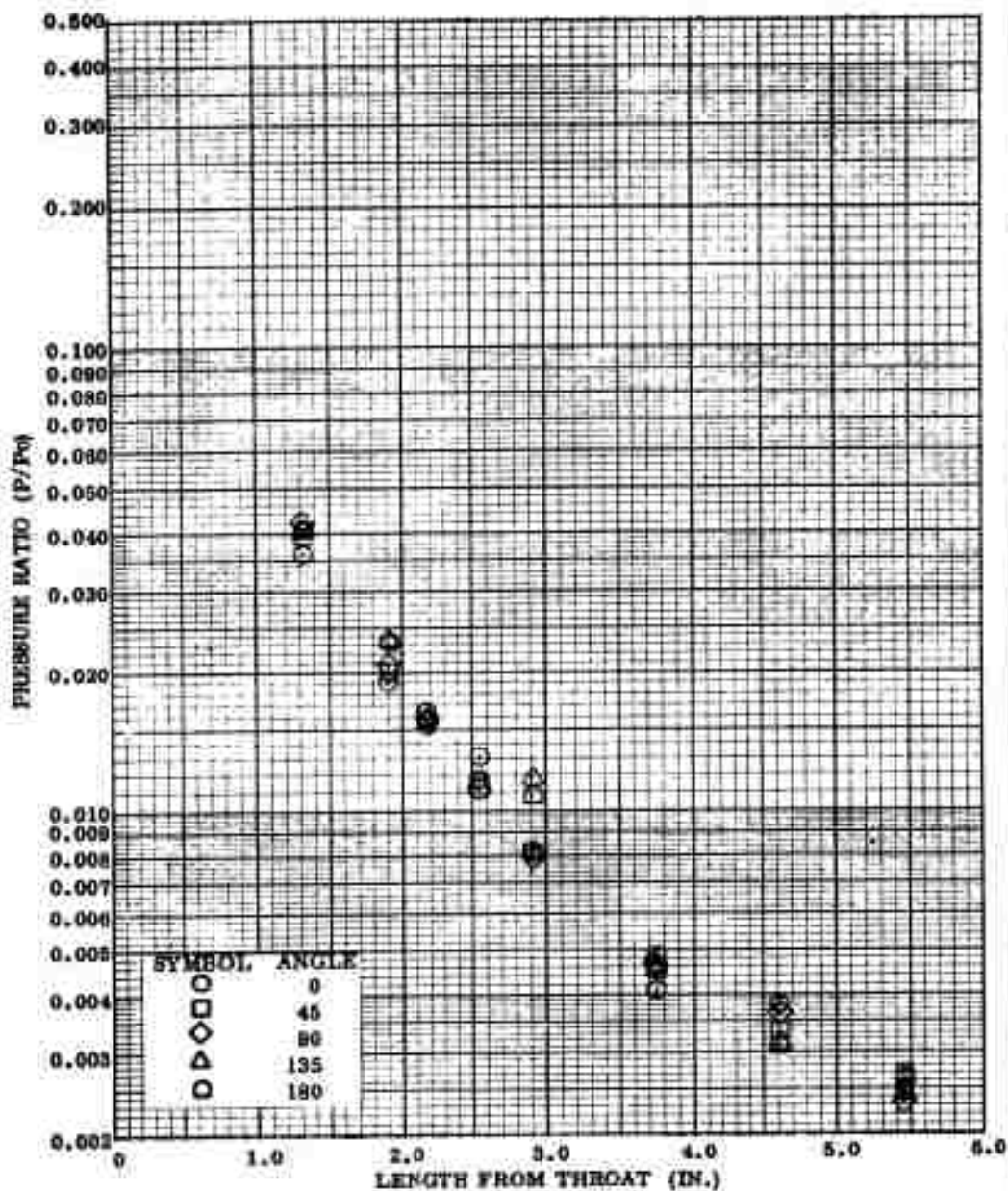Flex-X Cold Flow Run No. 17 , Vector Angle 0 Degrees

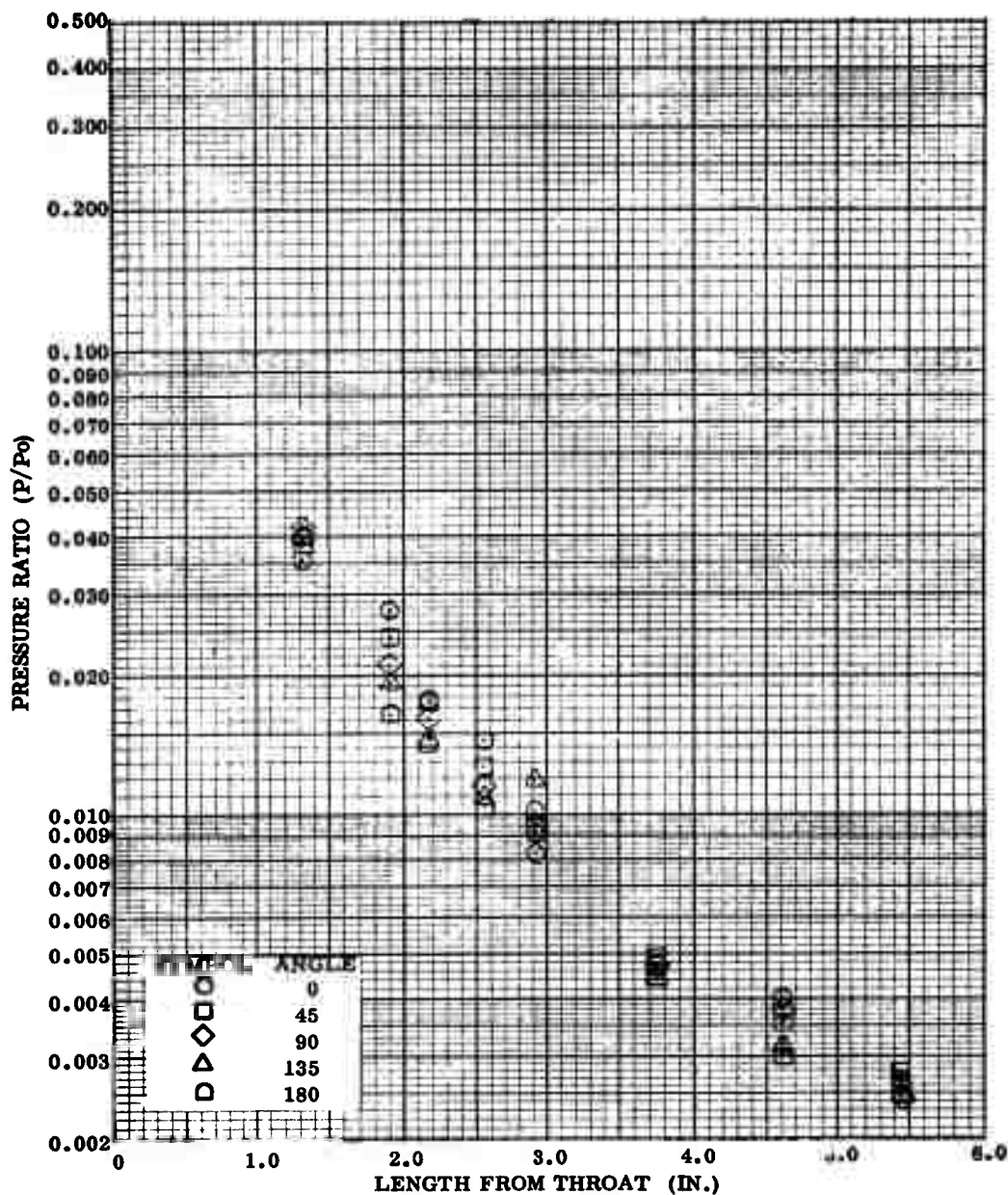Flex-X Cold Flow Run No. 17 , Vector Angle 2.5 Degrees
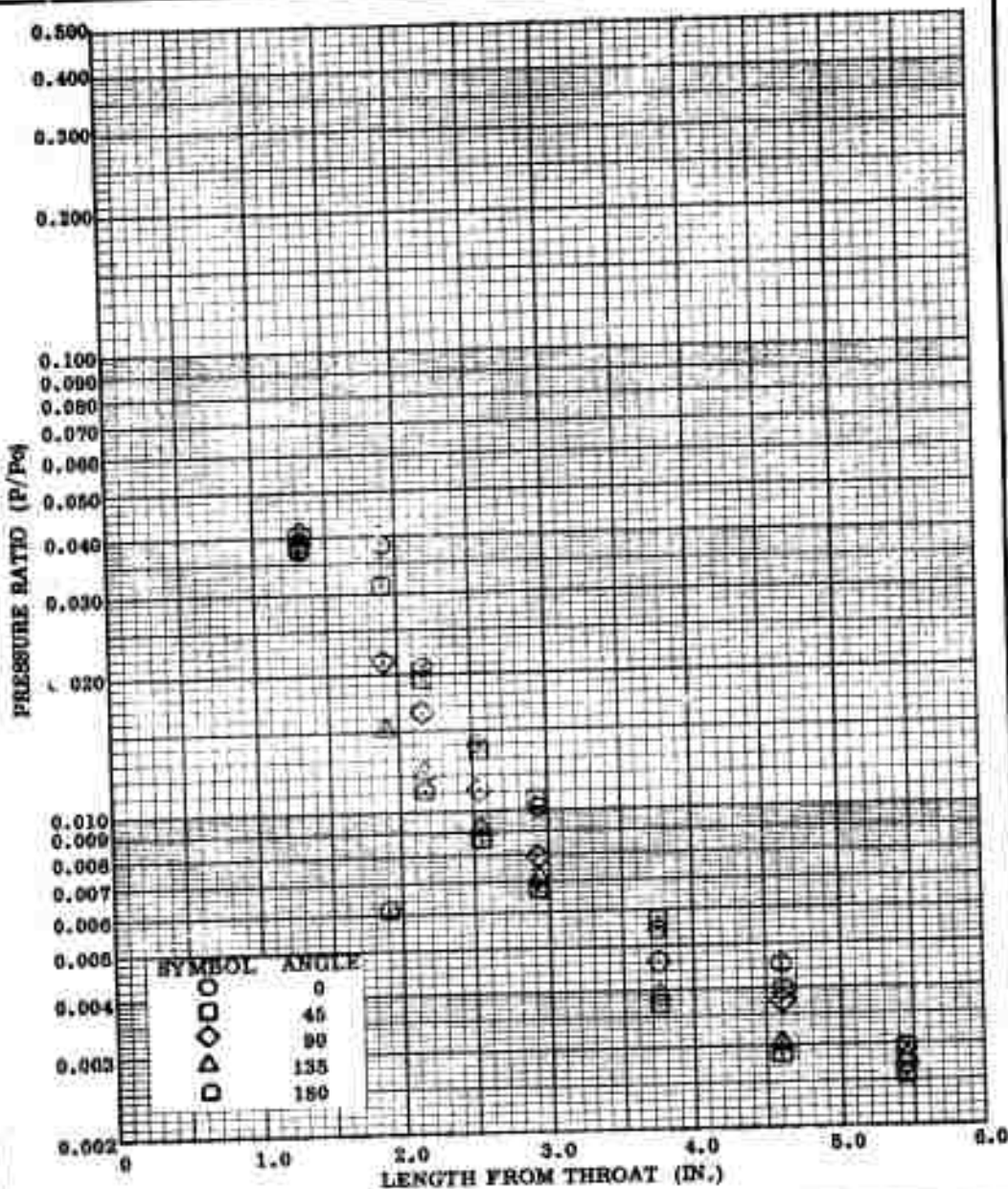
Flex-X Cold Flow Run No. 17 , Vector Angle 5 Degrees

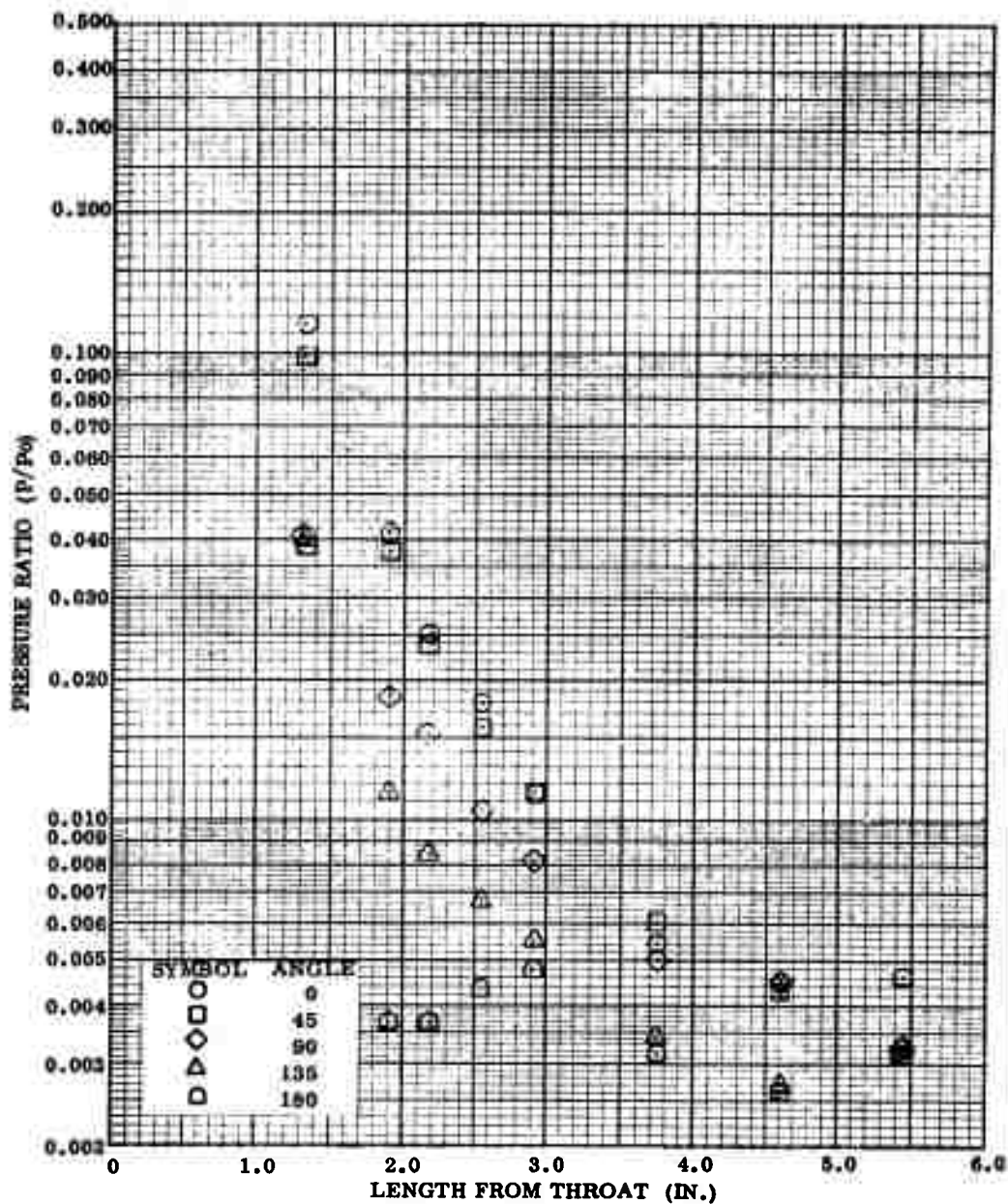Flex-X Cold Flow Run No. 17 , Vector Angle 10 Degrees

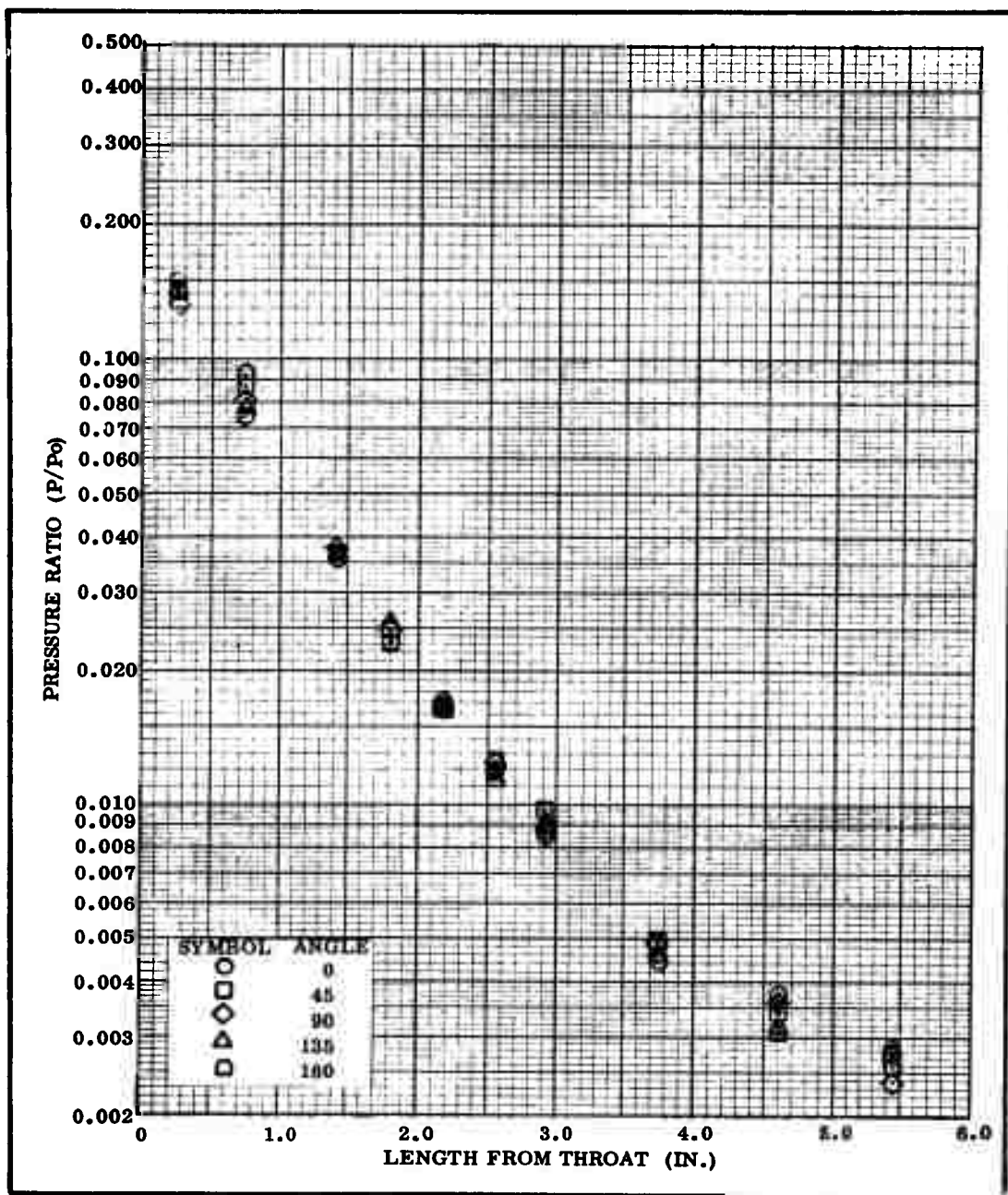Flex-X Cold Flow Run No. 18 , Vector Angle 0   Degrees

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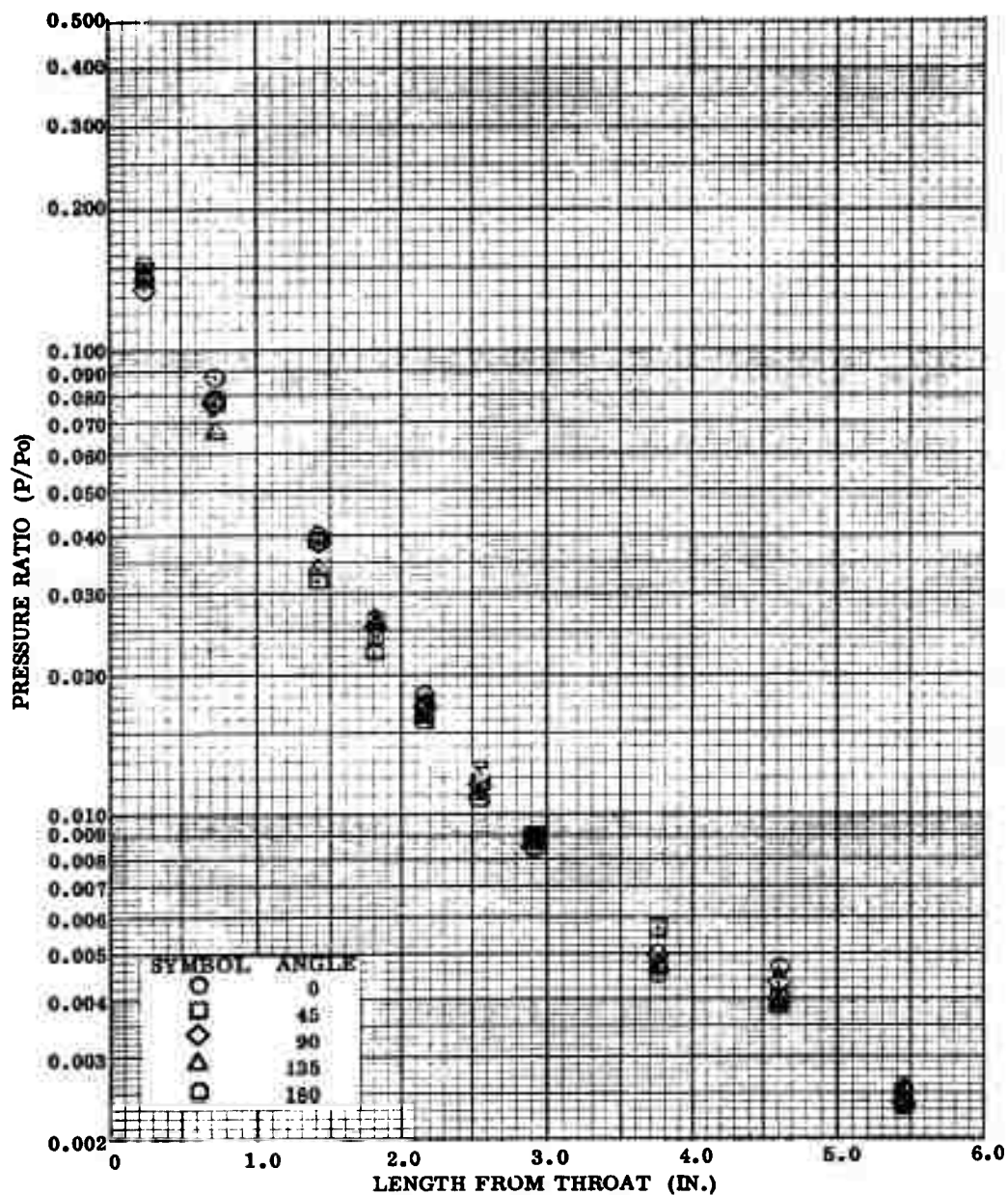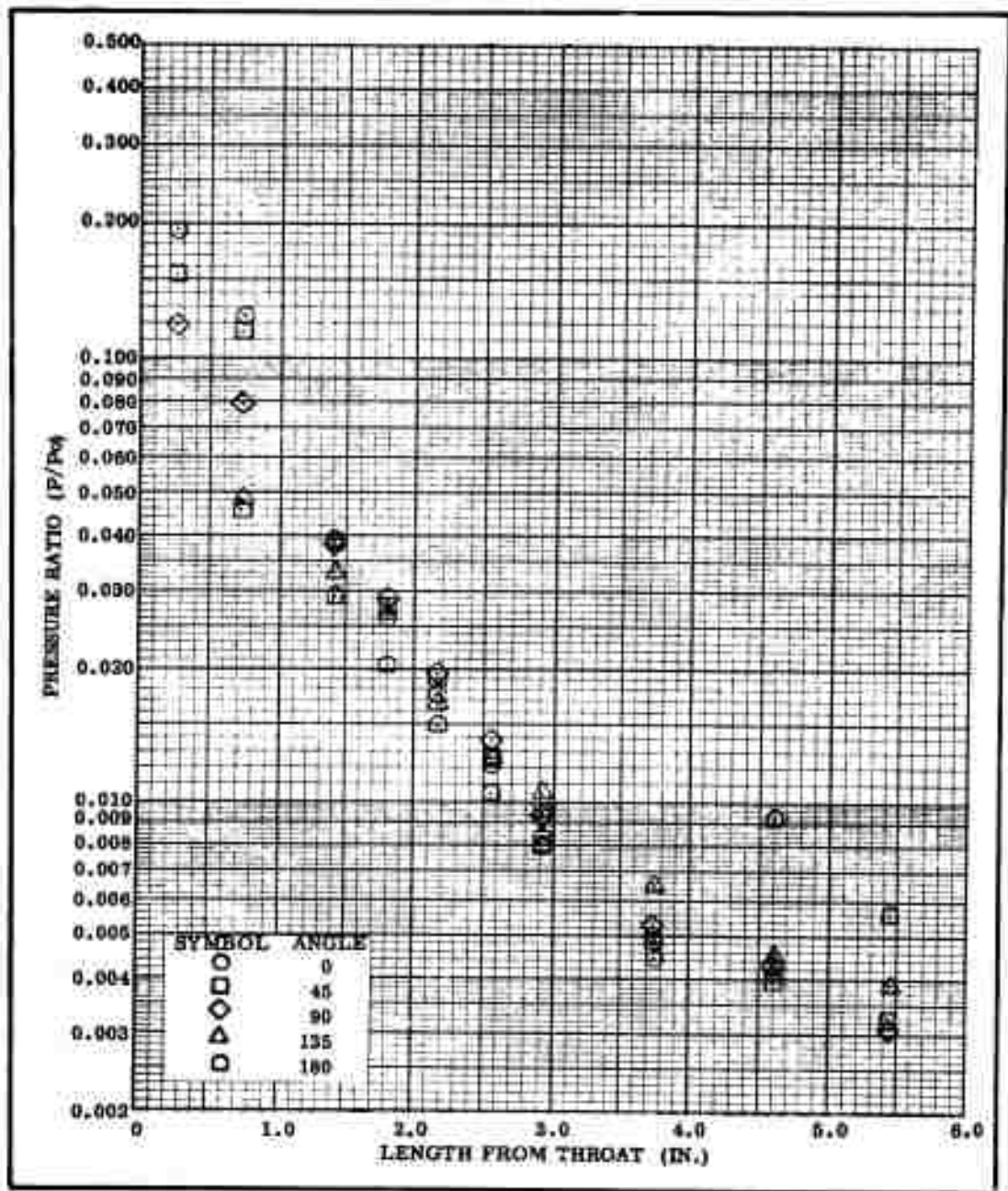Flex-X Cold Flow Run No. 18 , Vector Angle 2.5 Degrees

Flex-X Cold Flow Run No. 18 , Vector Angle 5   Degrees
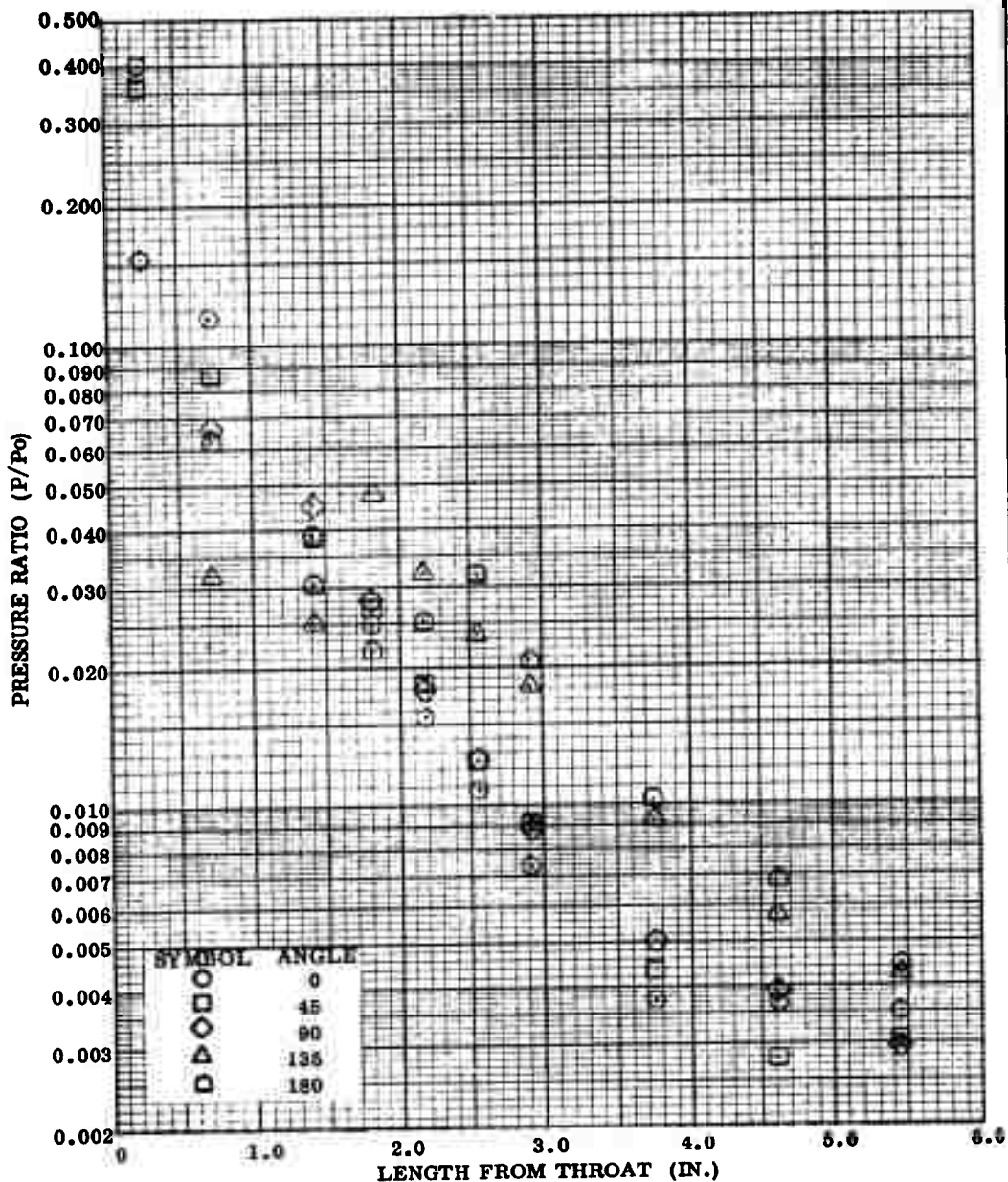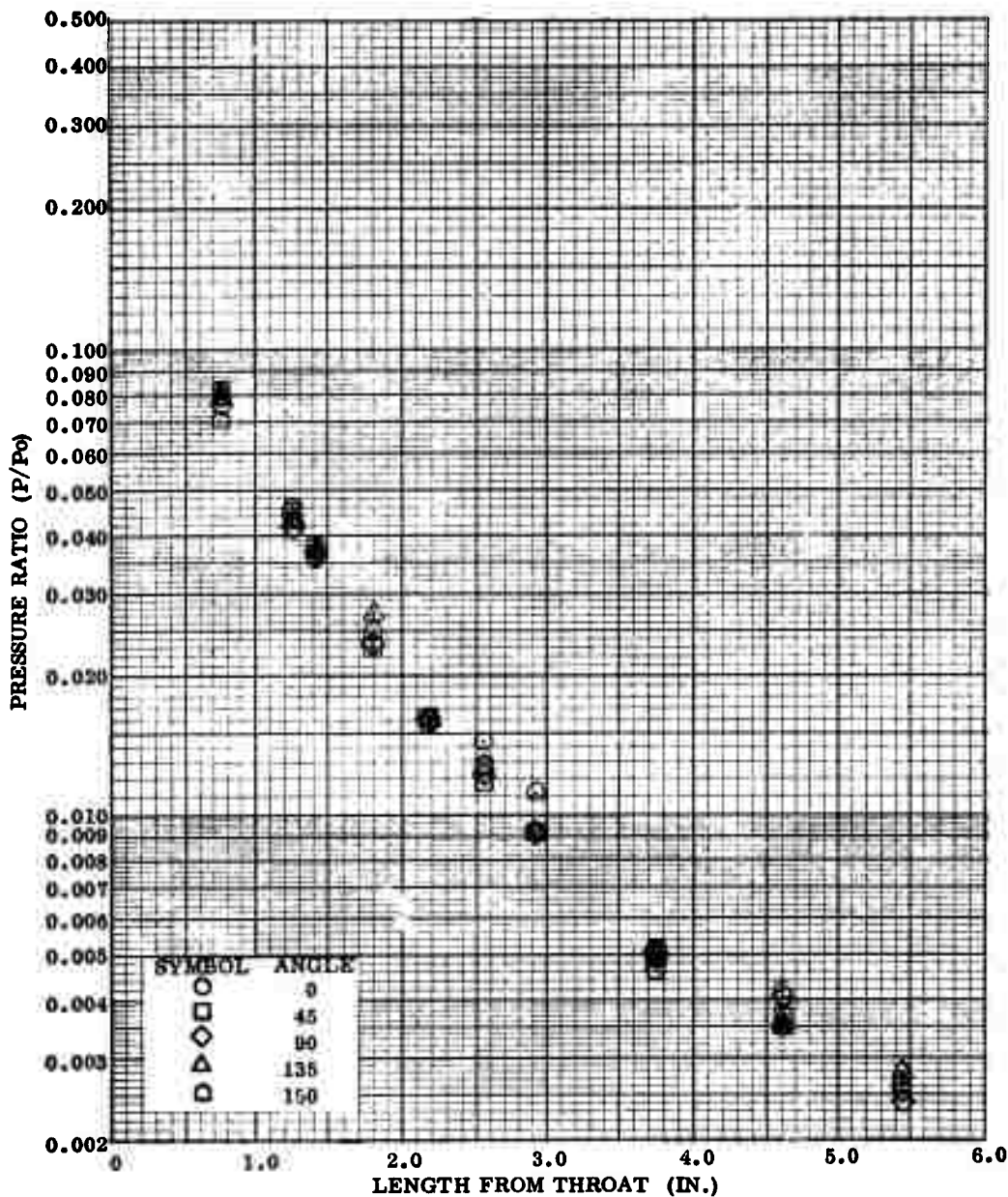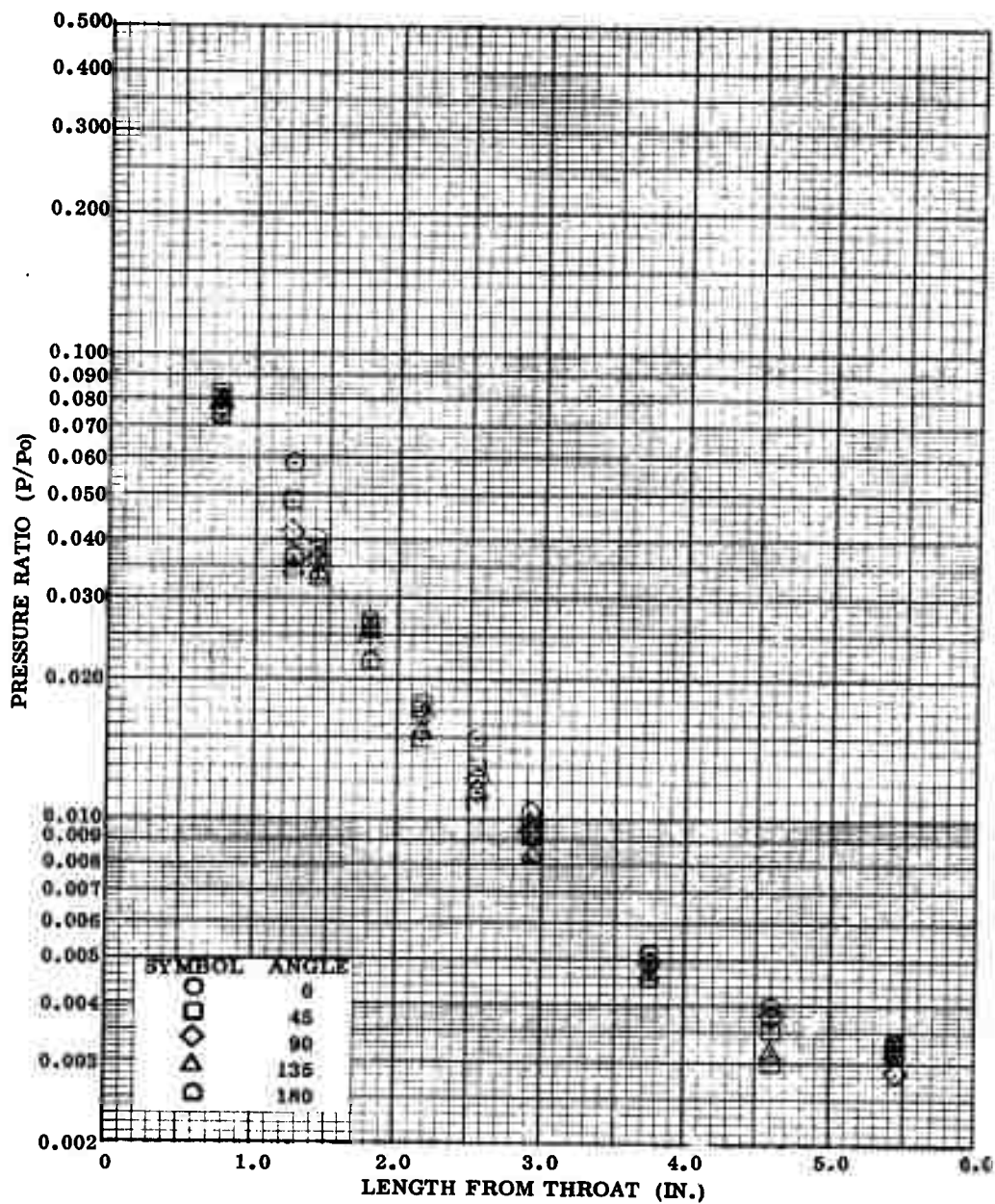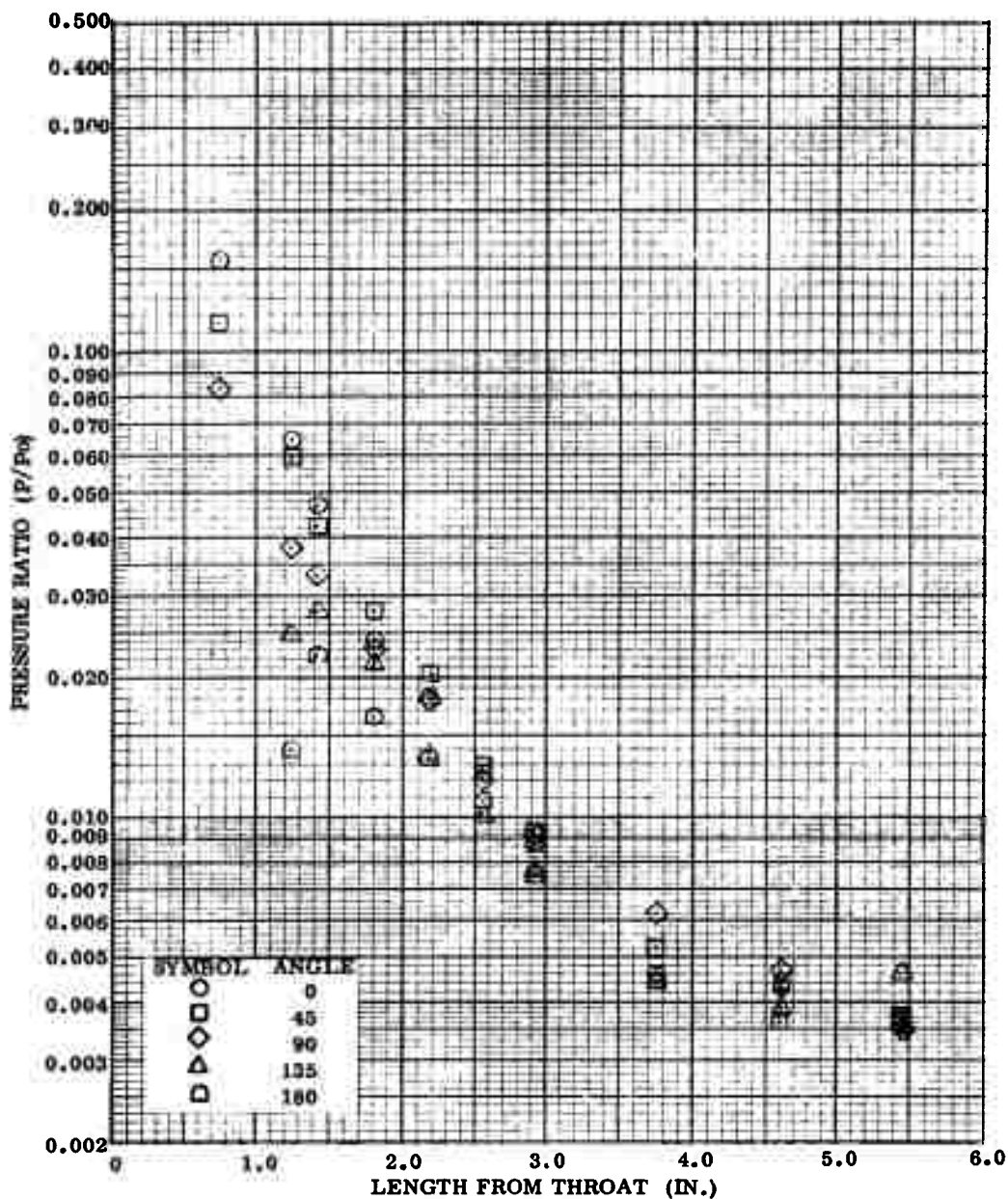
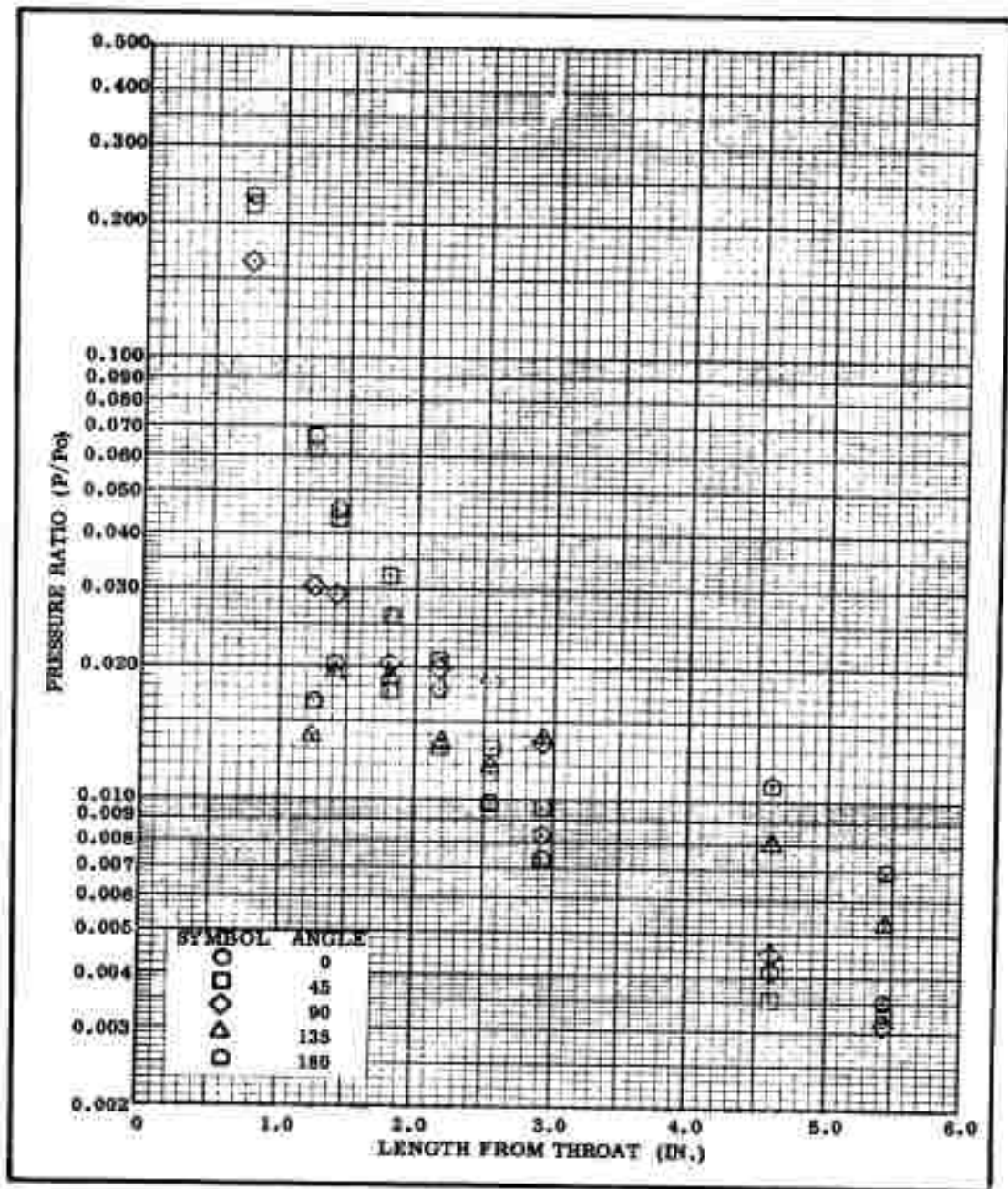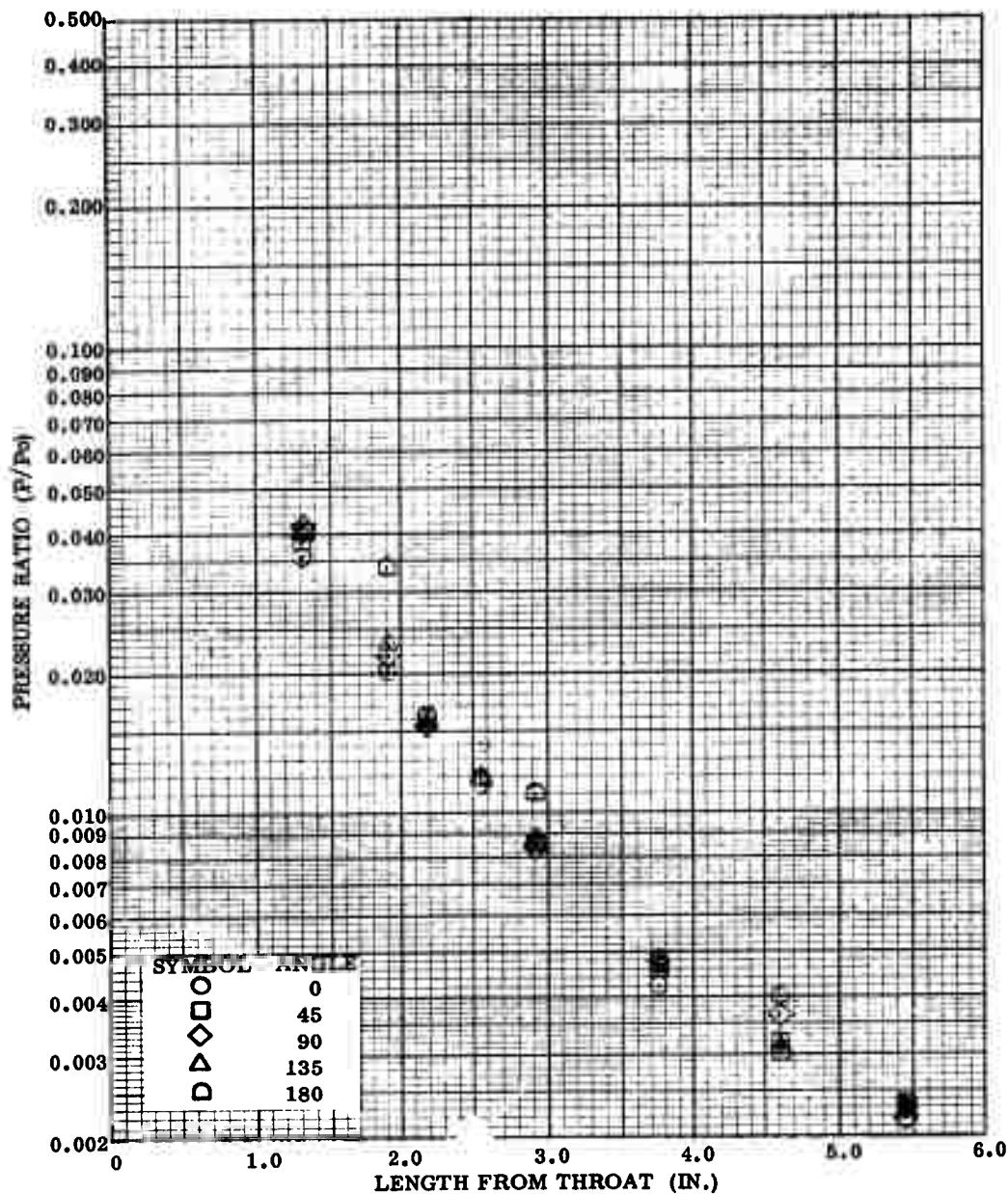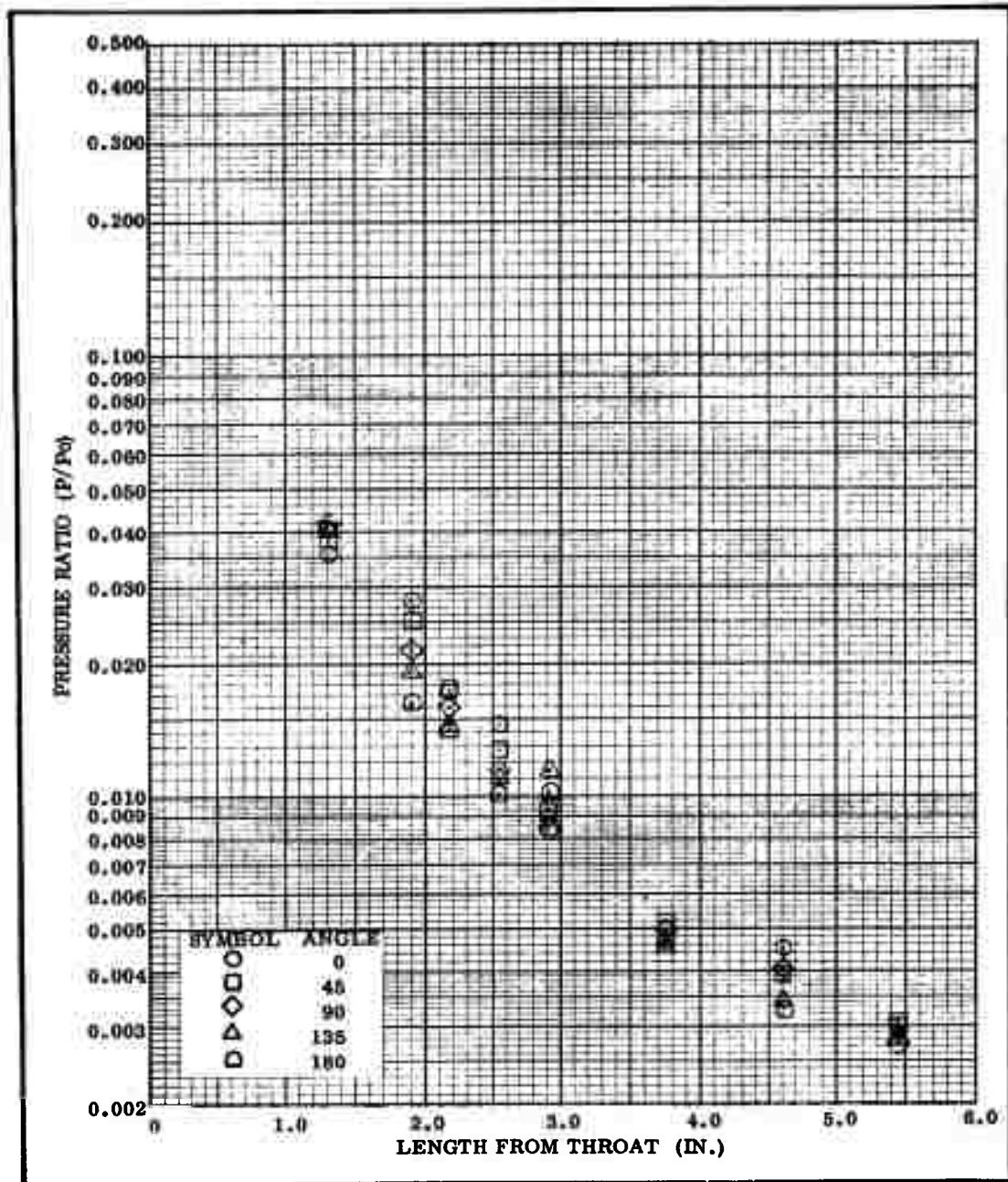Flex-X Cold Flow Run No. 18 , Vector Angle 10 Degrees

Flex-X Cold Flow Run No. 19, Vector Angle 0 Degrees

113

PRESSURE RATIO (P/Po)

0.500
0.400
0.300
0.200

0.100
0.080
0.060
0.040
0.030
0.020

0.010
0.008
0.006
0.004
0.003
0.002

0.001

SYMBOL	ANGLE
○	0
□	45
◇	90
△	135
⌂	180

1.0   2.0   3.0   4.0   5.0   6.0   7.0   8.0

LENGTH FROM THROAT (IN.)

18522-42

Flex-X Cold Flow Run No. 19, Vector Angle 2.5 Degrees

114

PRESSURE RATIO (P/Po)

0.500
0.400
0.300
0.200

0.100
0.080
0.060
0.040
0.030
0.020

0.010
0.008
0.006
0.004
0.003

0.002

0.001

SYMBOL	ANGLE
○	0
□	45
◇	90
△	135
⊡	180

LENGTH FROM THROAT (IN.)
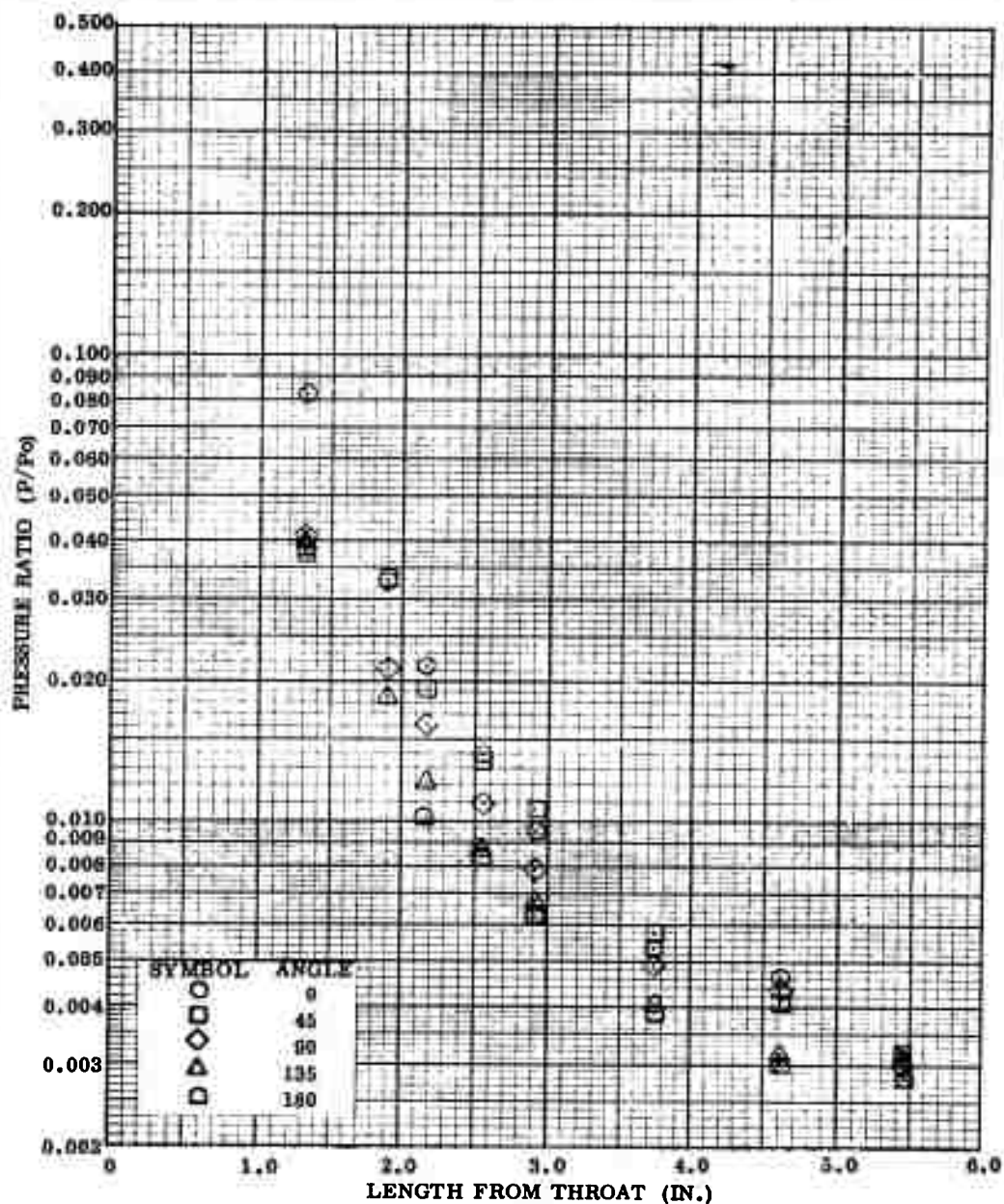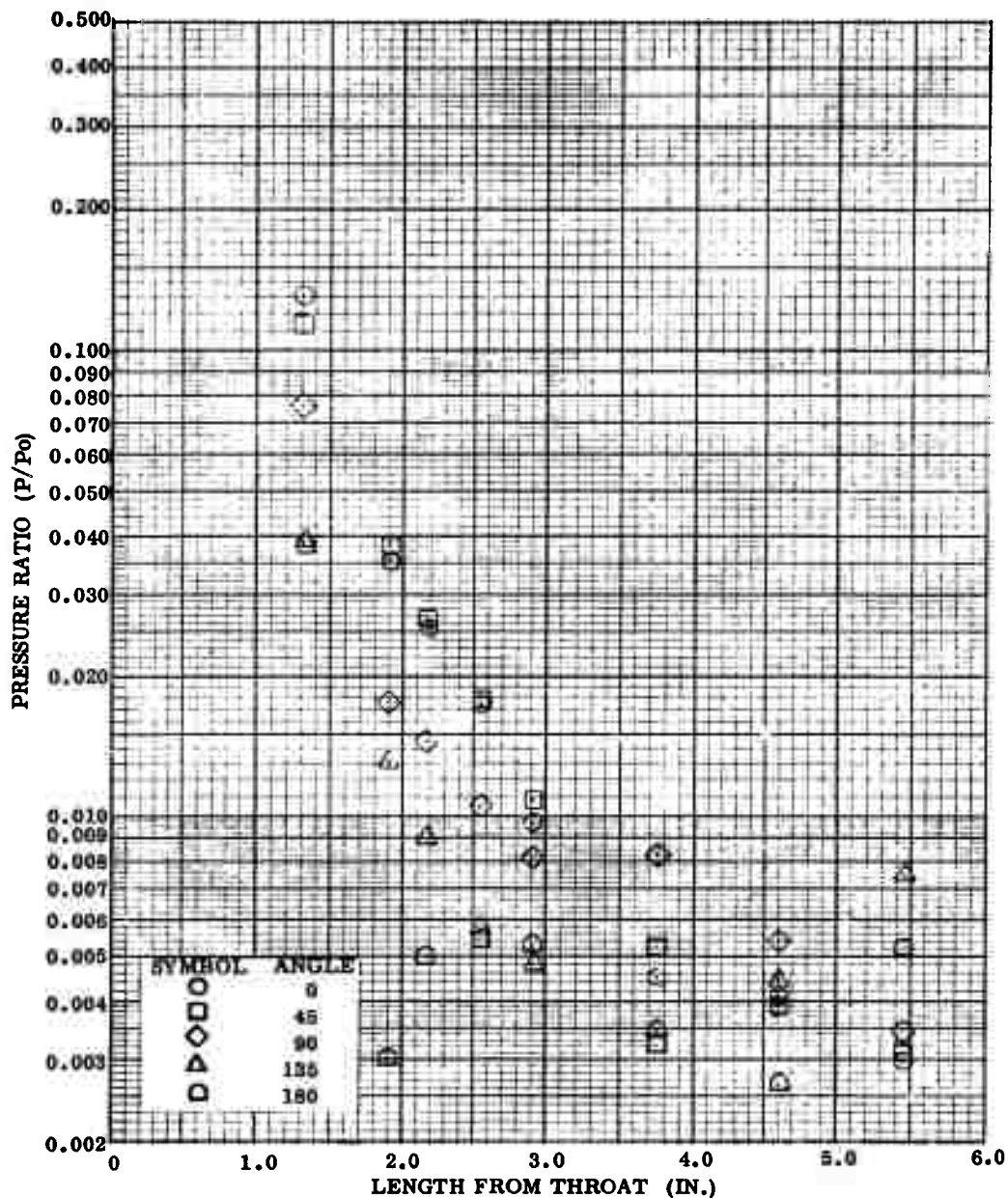
1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0

19523-41

Flex-X Cold Flow Run No. 19, Vector Angle 5 Degrees

Flex-X Cold Flow Run No. 19, Vector Angle 10 Degrees
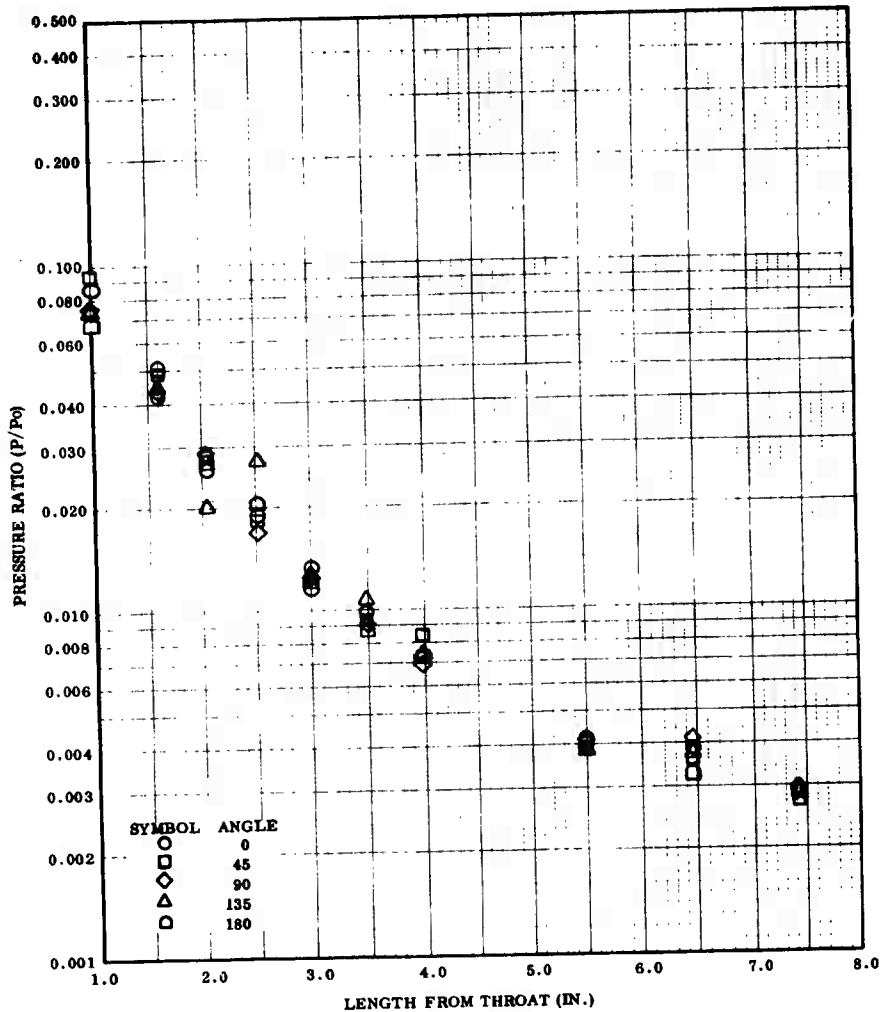
Flex-X Cold Flow Run No. 20 , Vector Angle 0   Degrees

Flex-X Cold Flow Run No. 20 , Vector Angle 2.5 Degrees
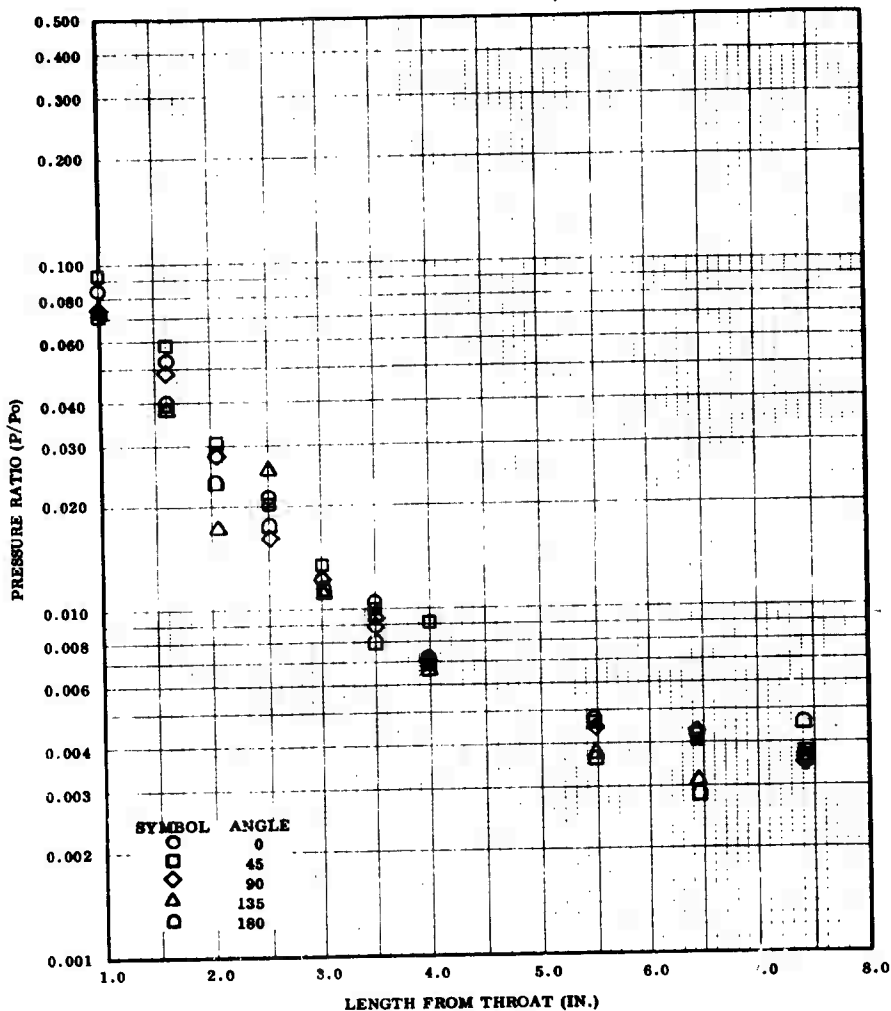
Flex-X Cold Flow Run No. 20, Vector Angle 5 Degrees
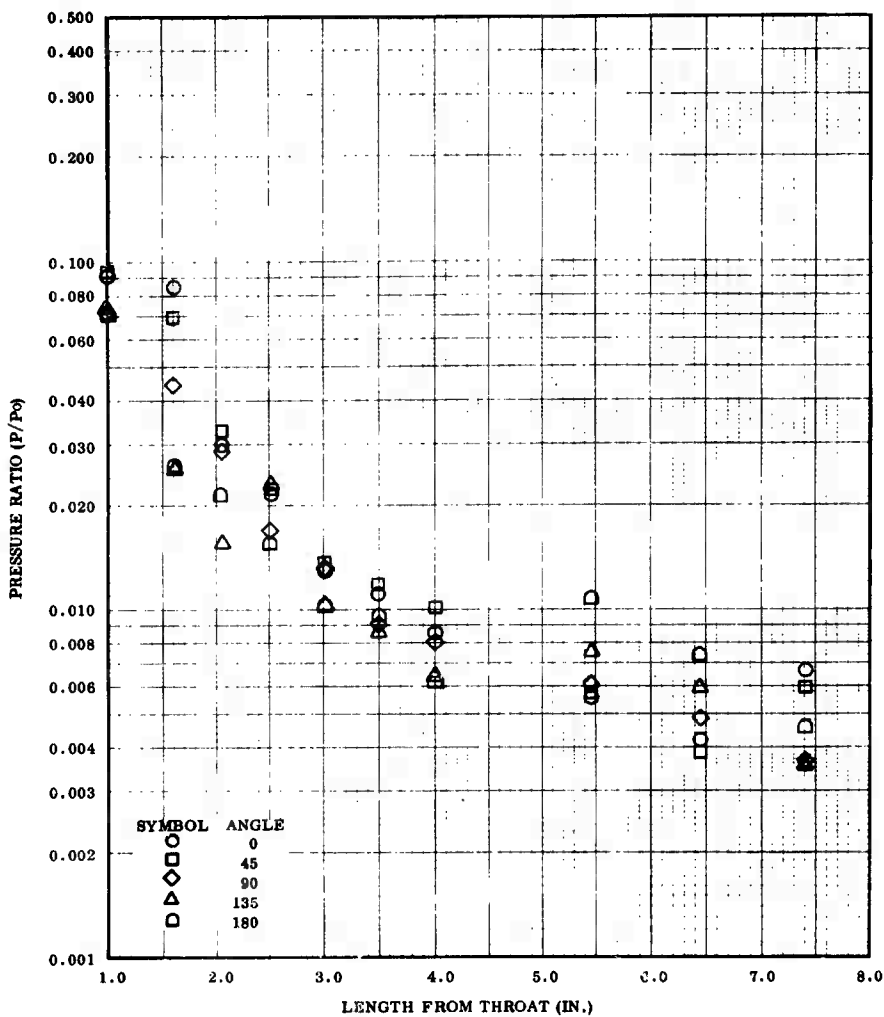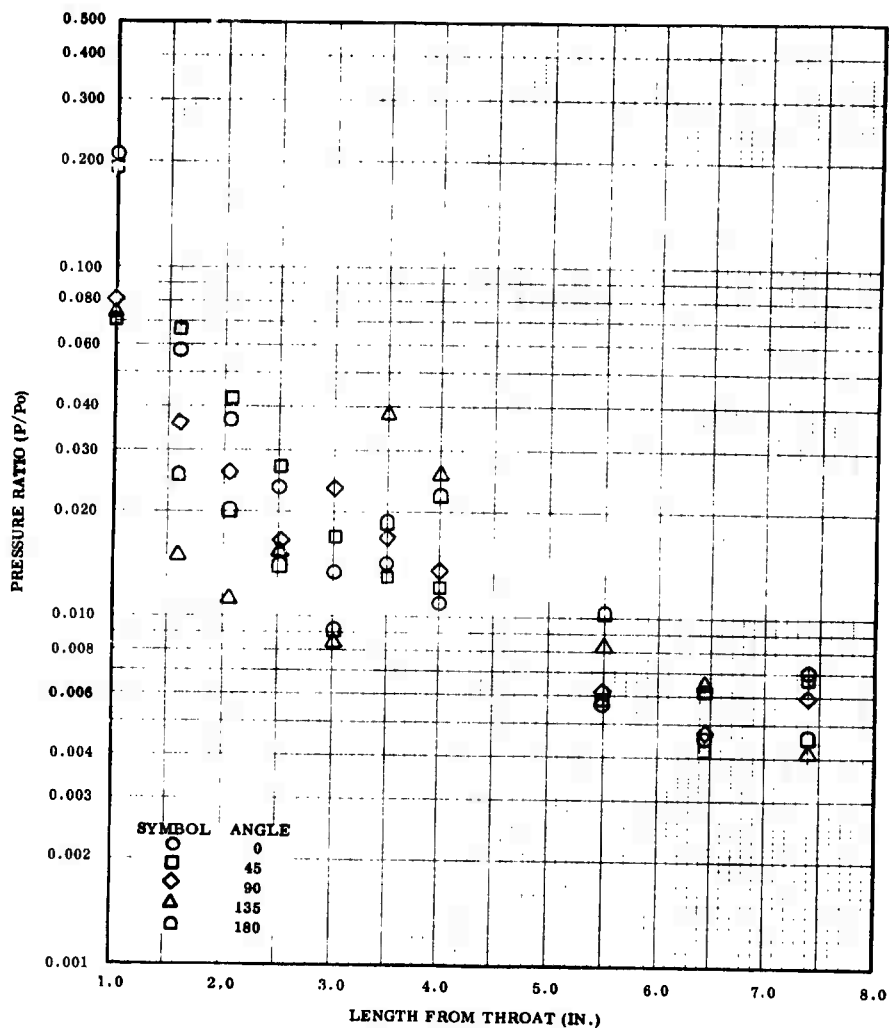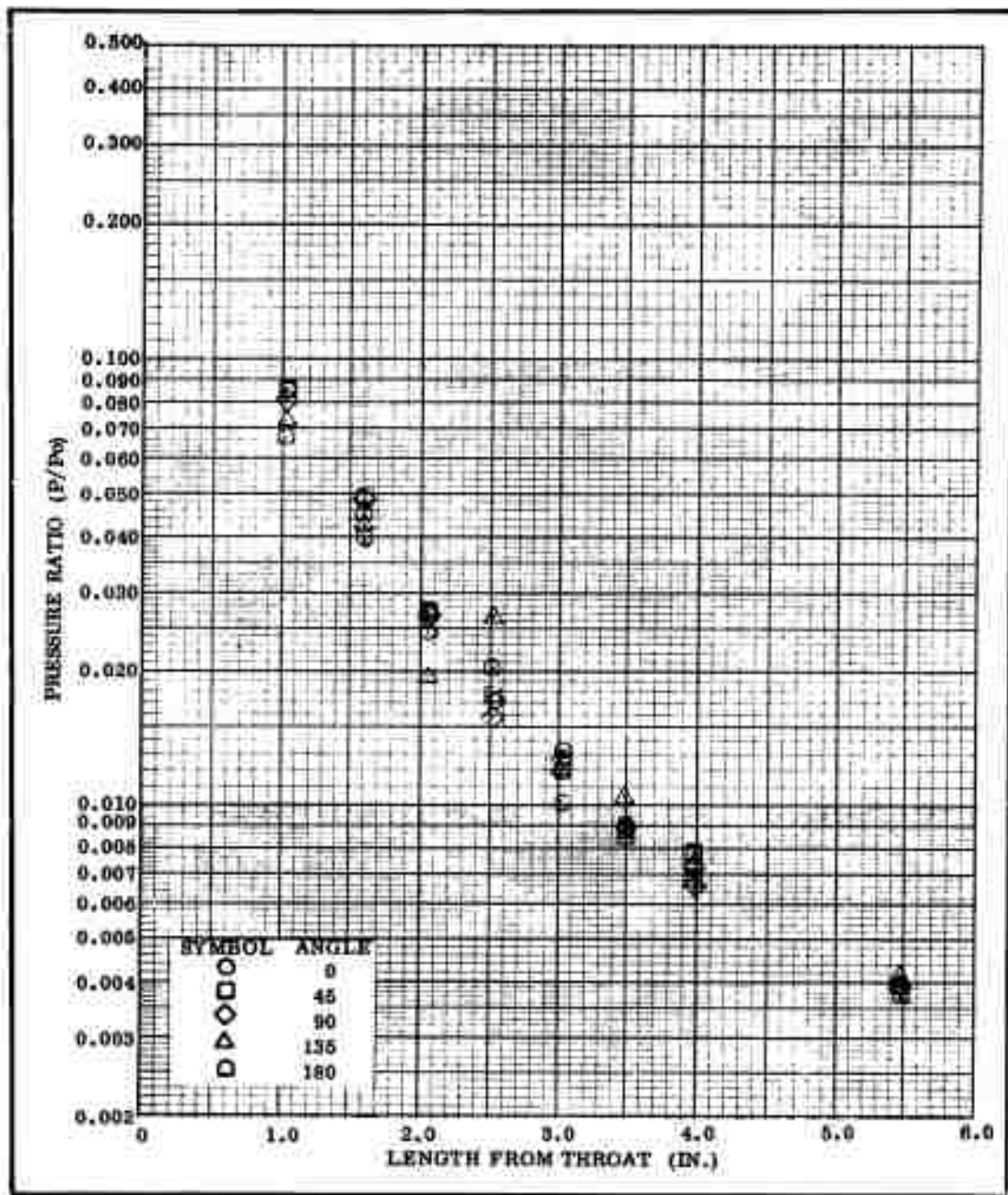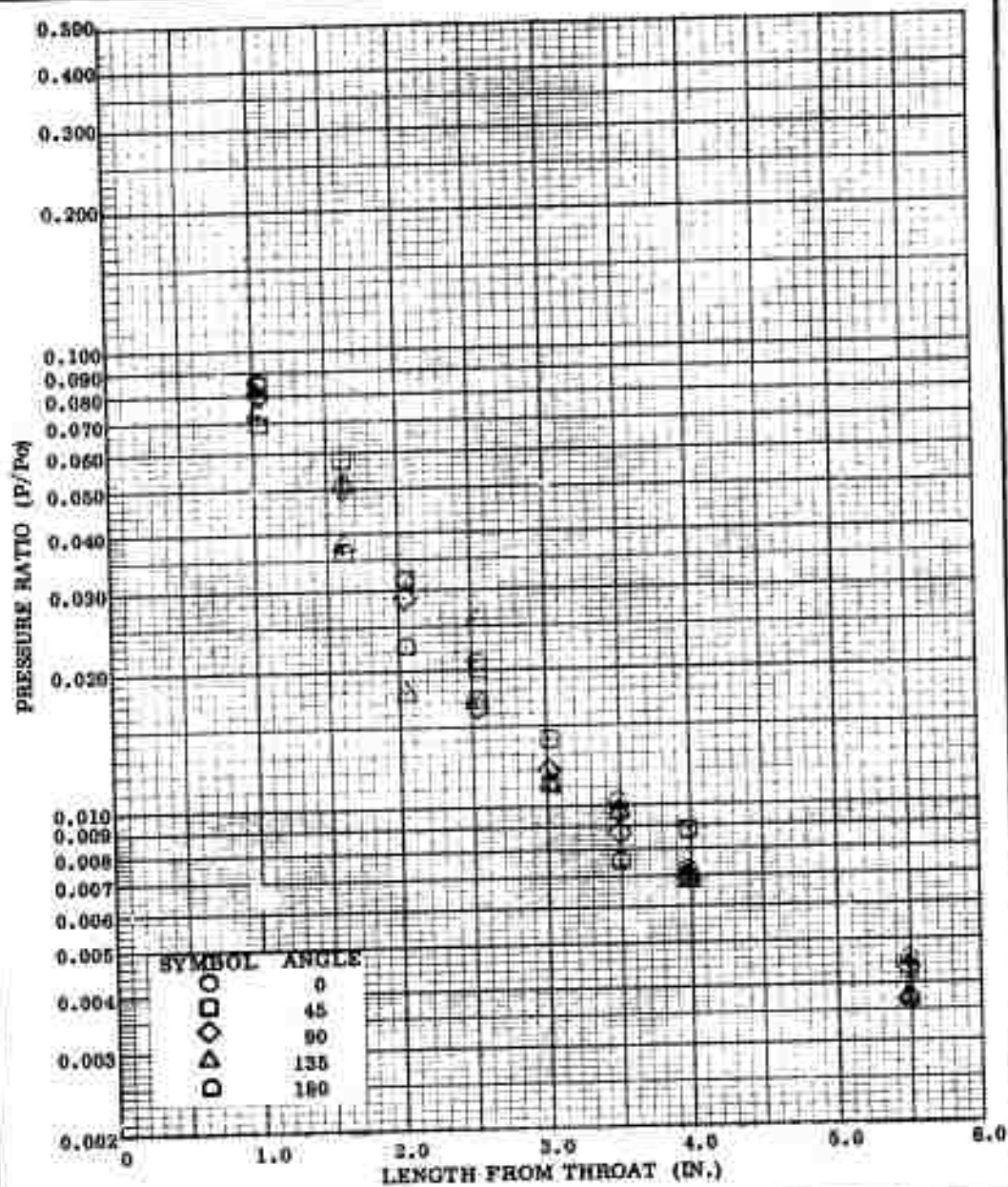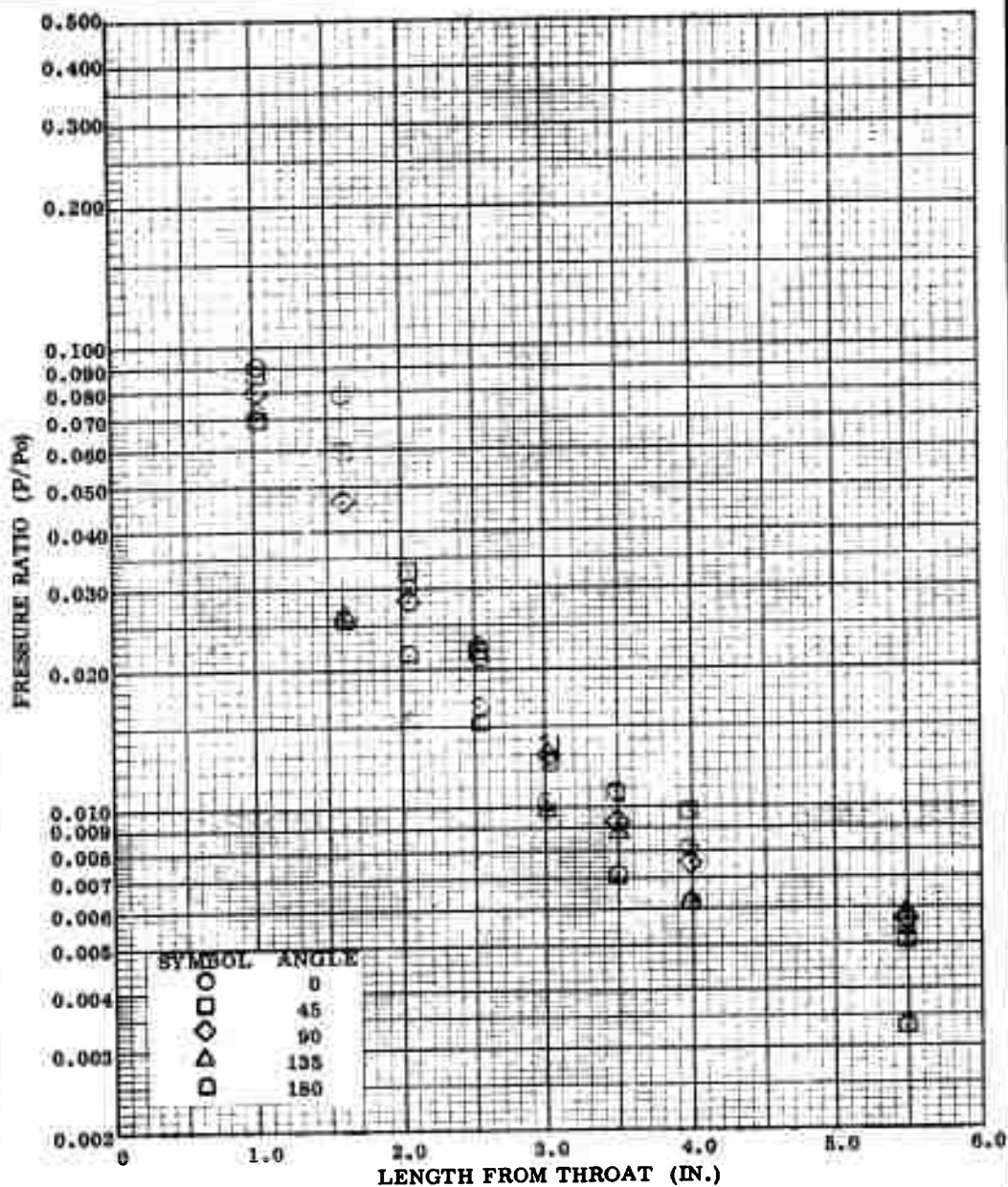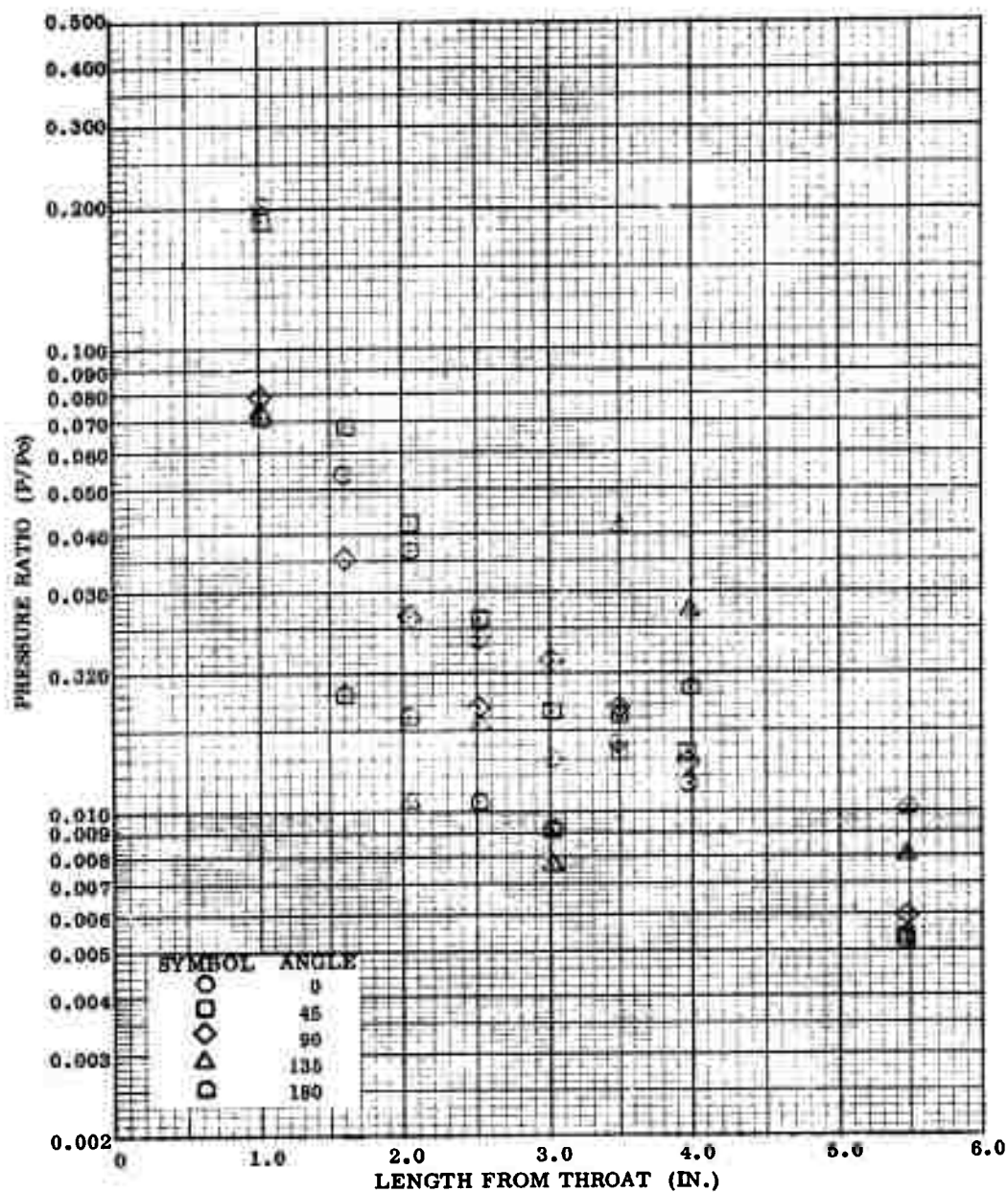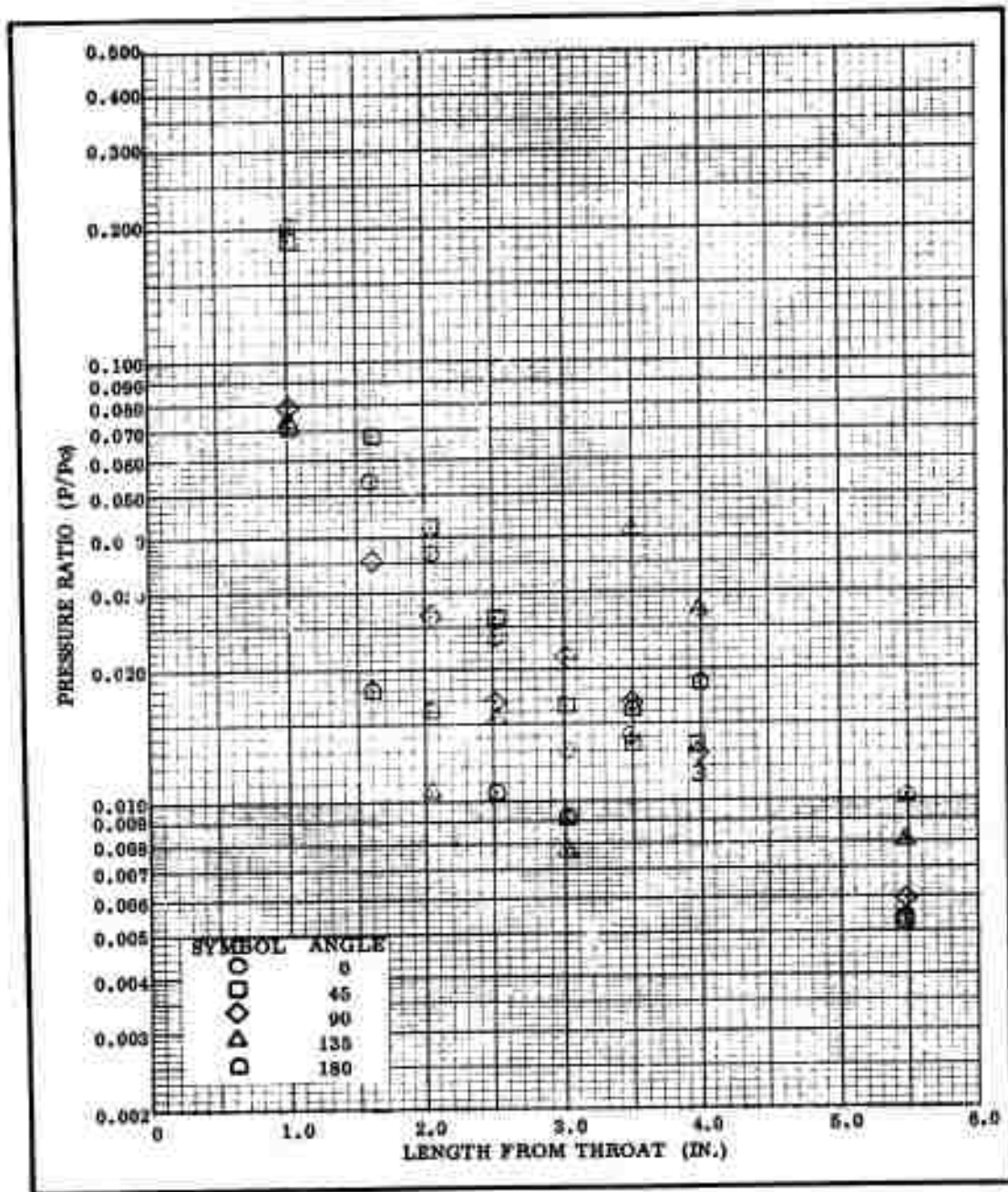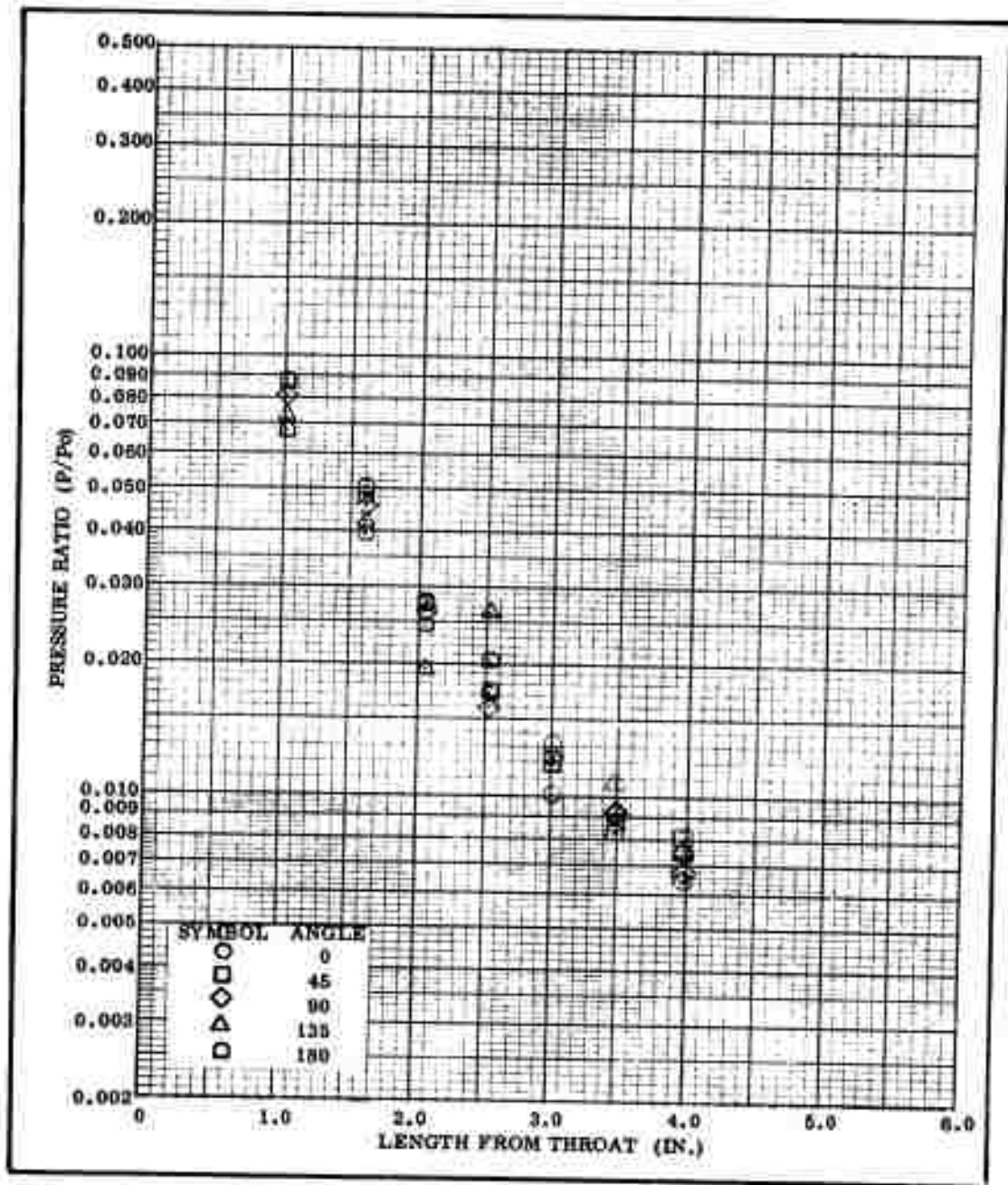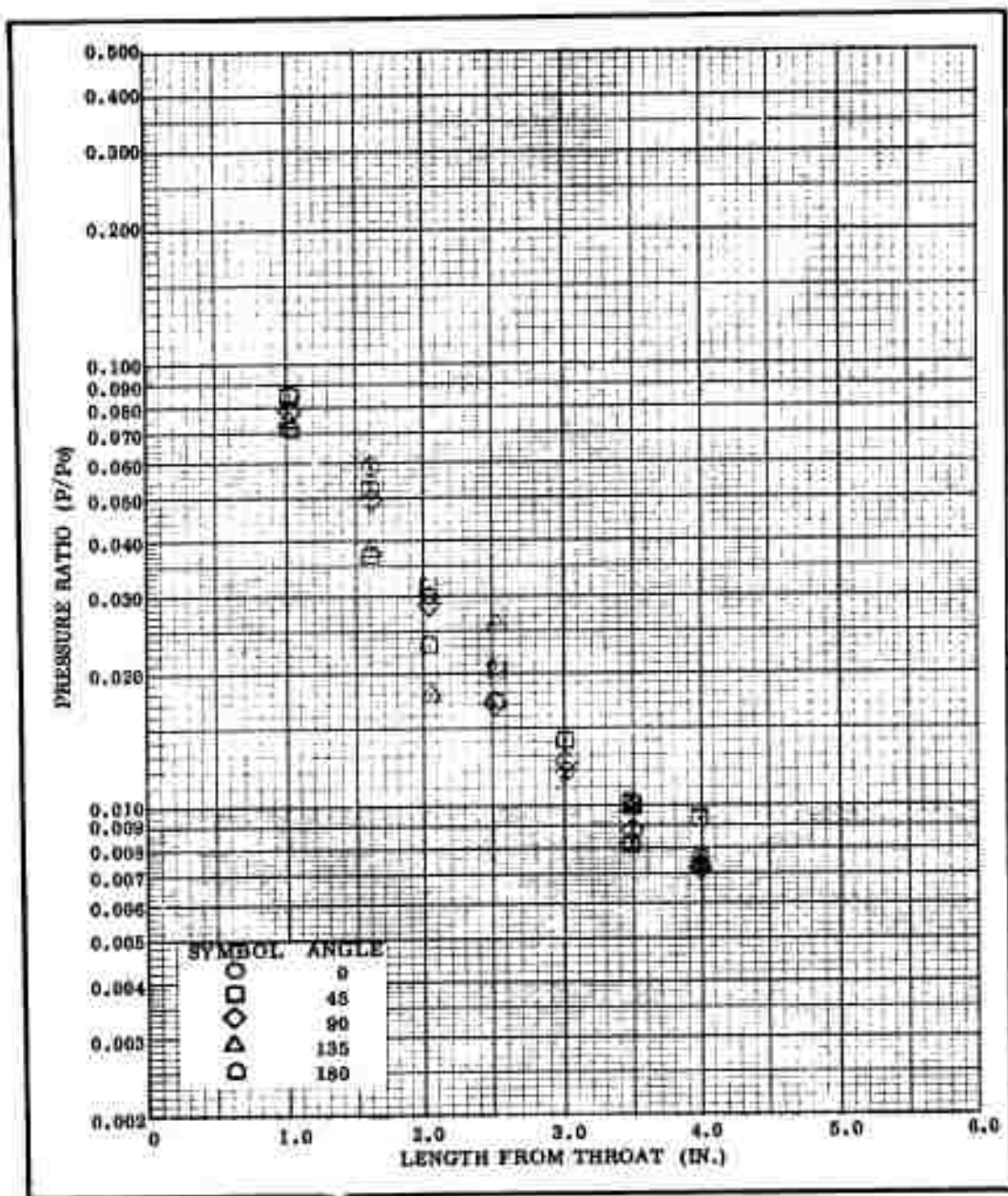
Flex-X Cold Flow Run No. 20 , Vector Angle 10 Degrees

Flex-X Cold Flow Run No. 20 , Vector Angle 10 Degrees

120

Flex-X Cold Flow Run No. 21 , Vector Angle 0 Degrees

Flex- X Cold Flow Run No. 21 , Vector Angle 2.5 Degrees

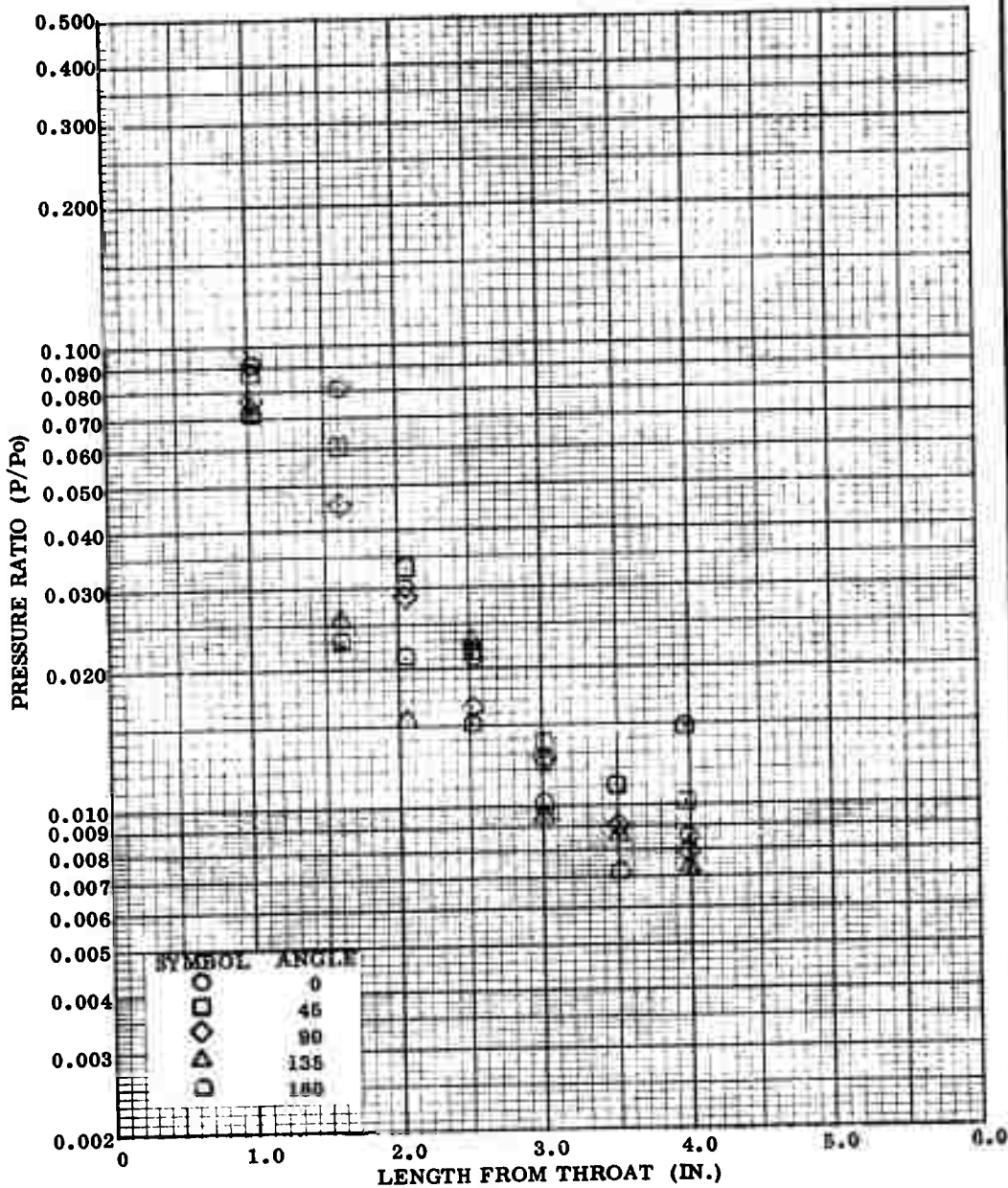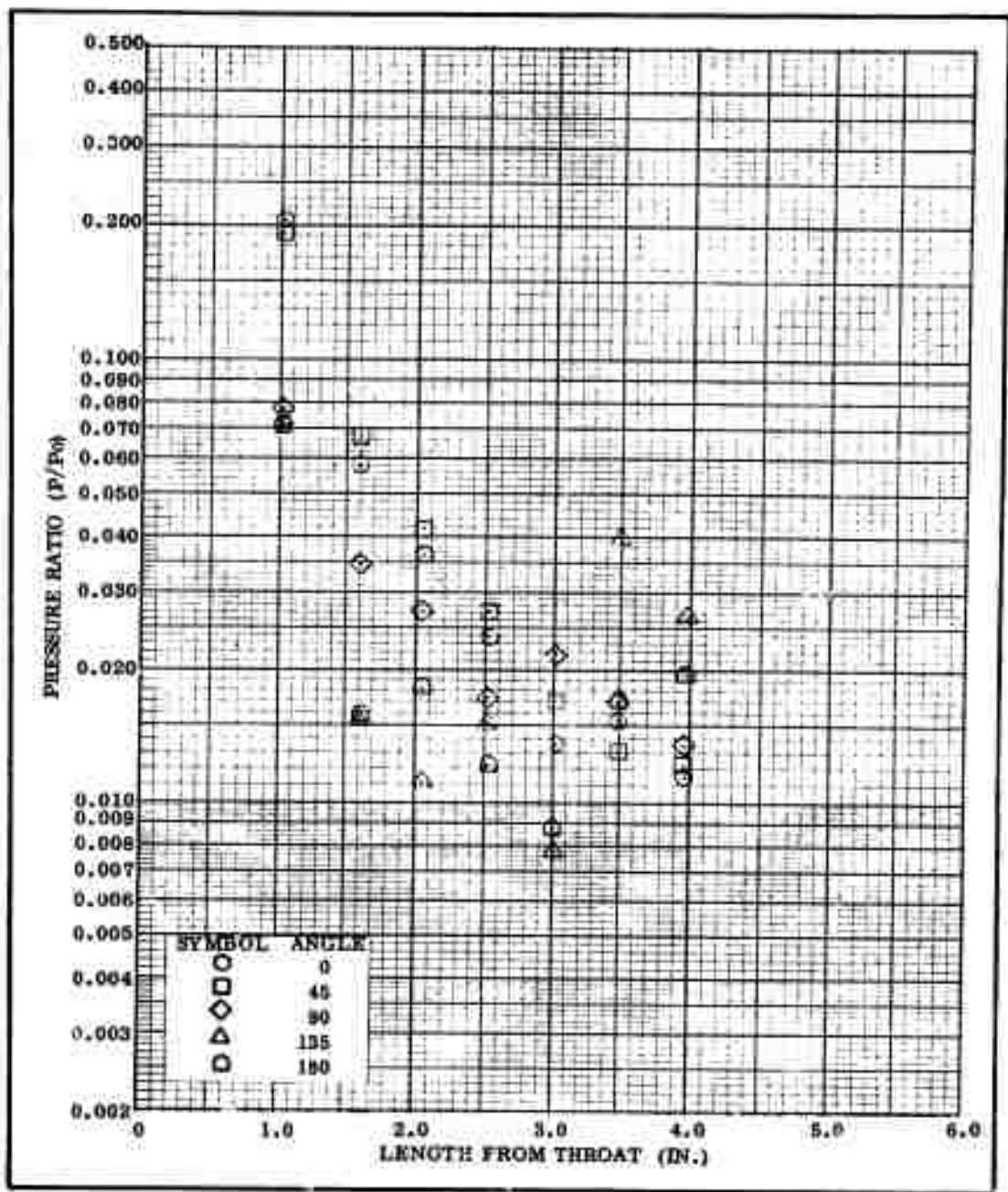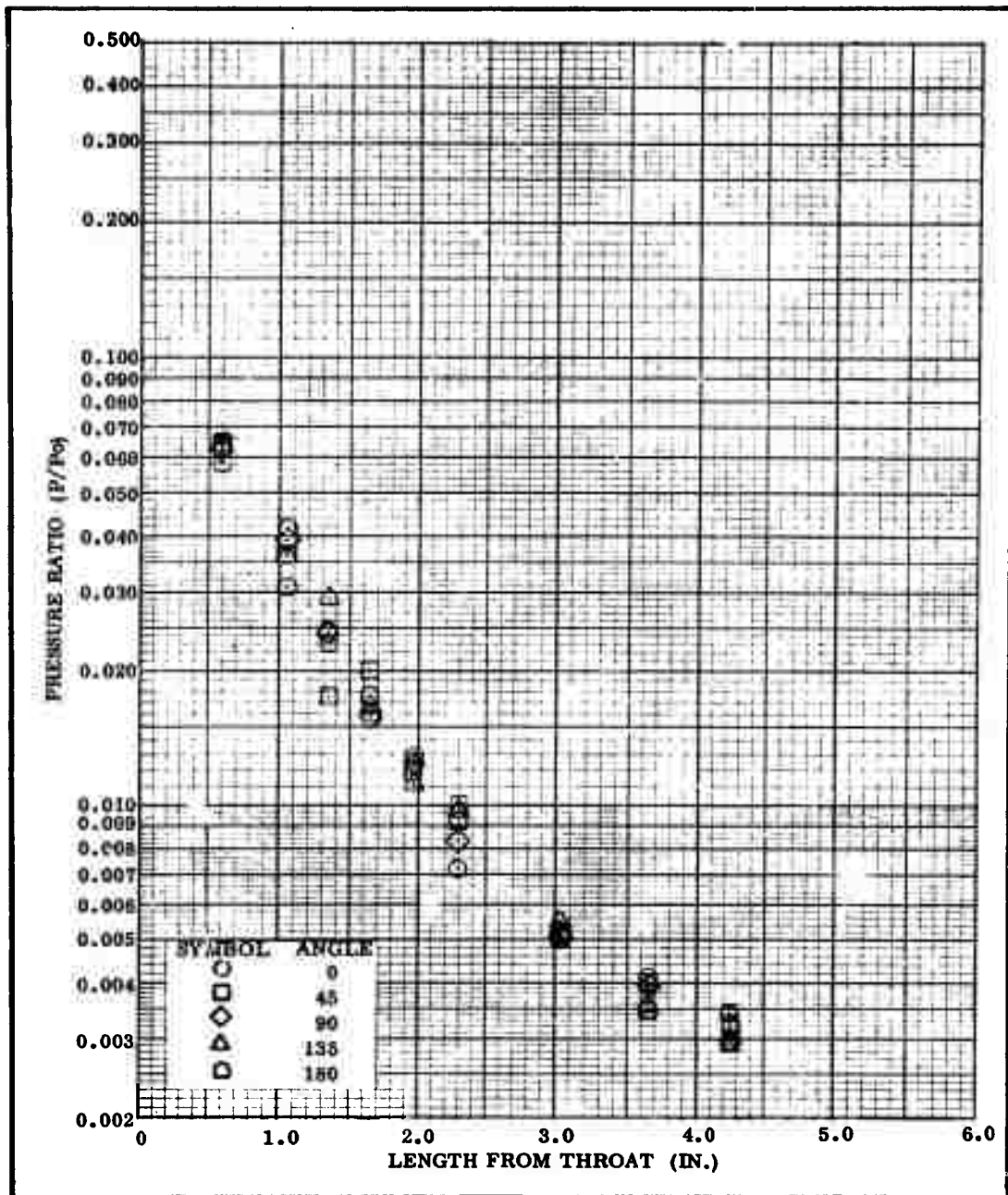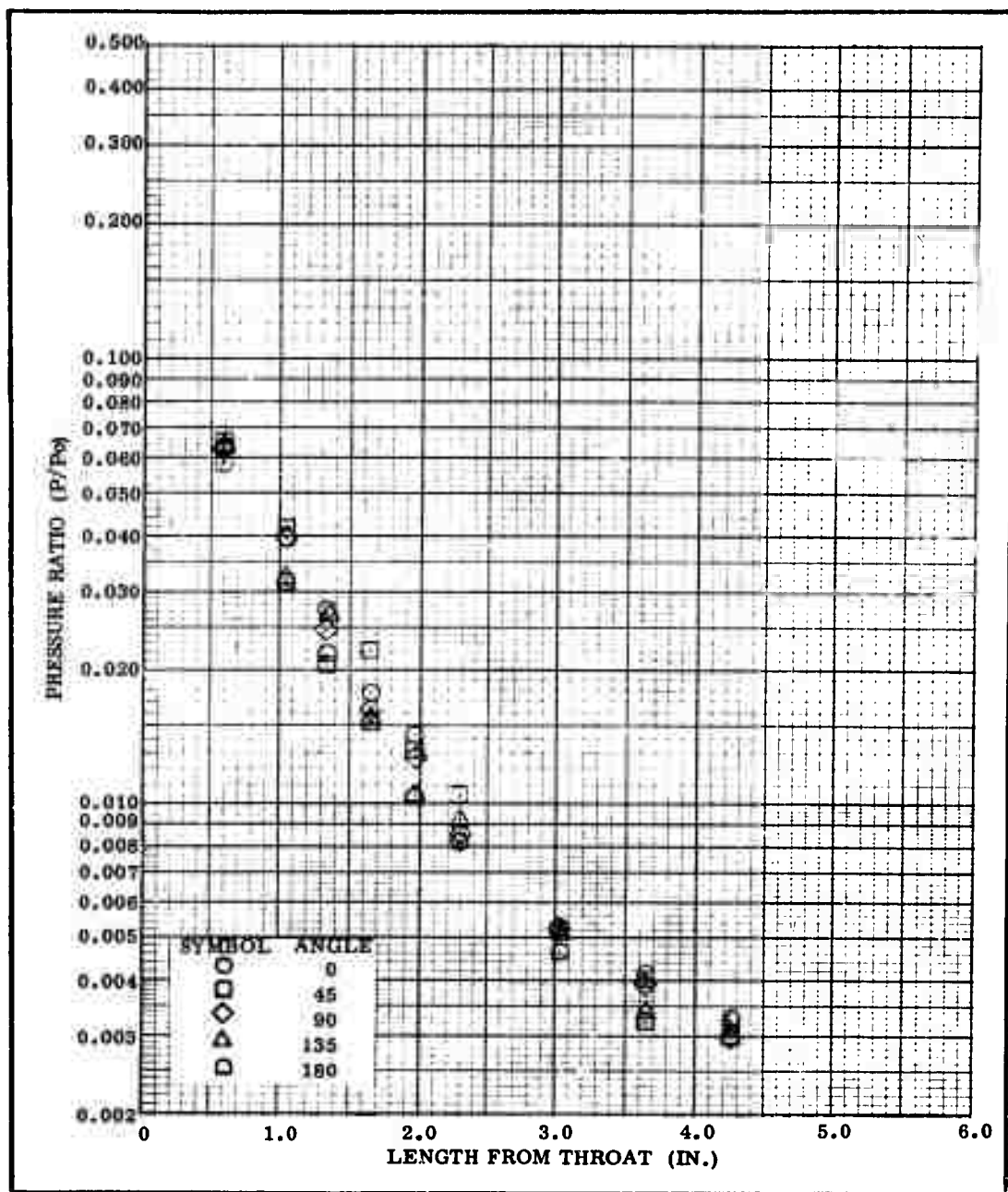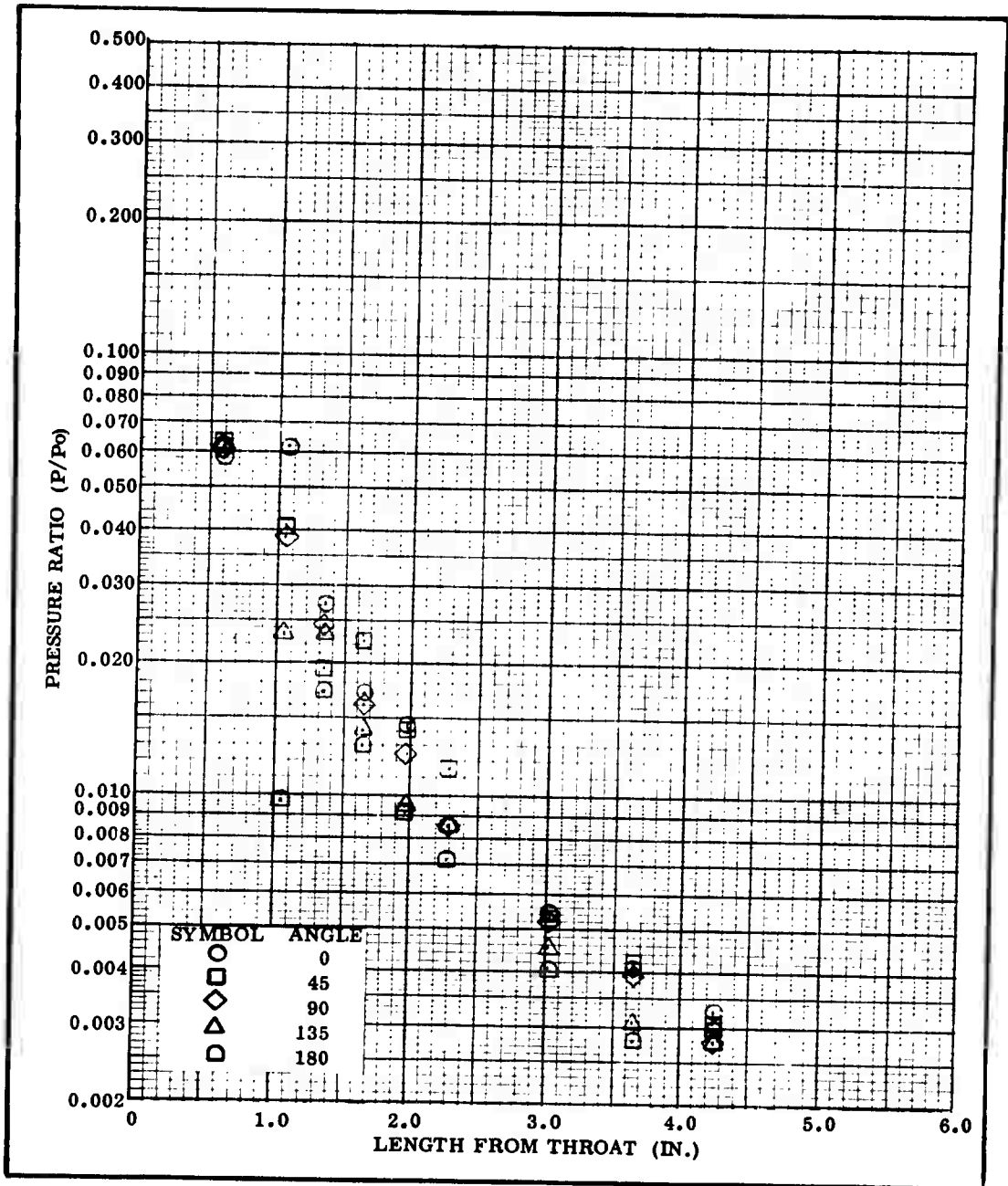Flex-X Cold Flow Run No. 21 , Vector Angle 5 Degrees

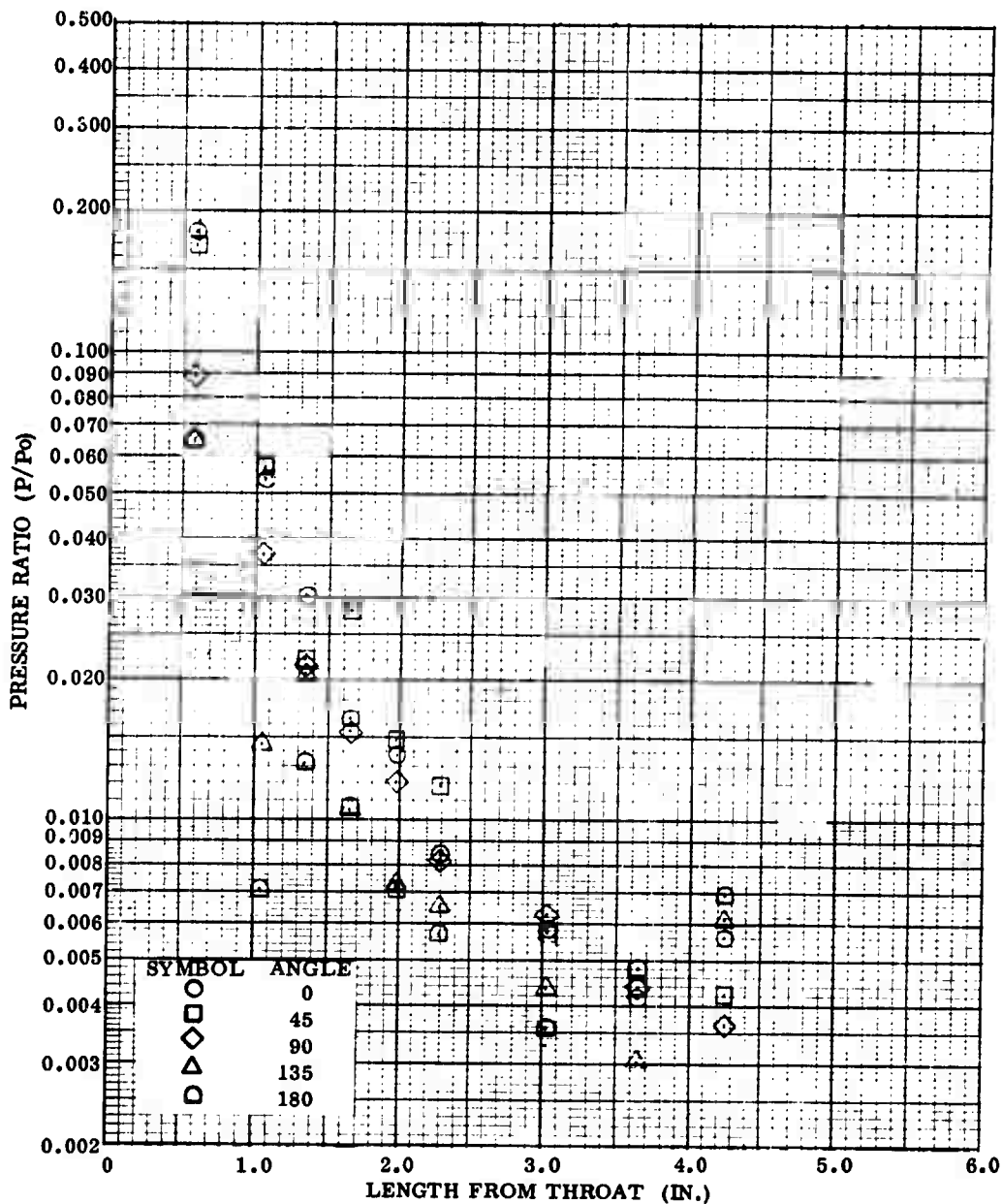Flex-X Cold Flow Run No. 21 , Vector Angle 10 Degrees

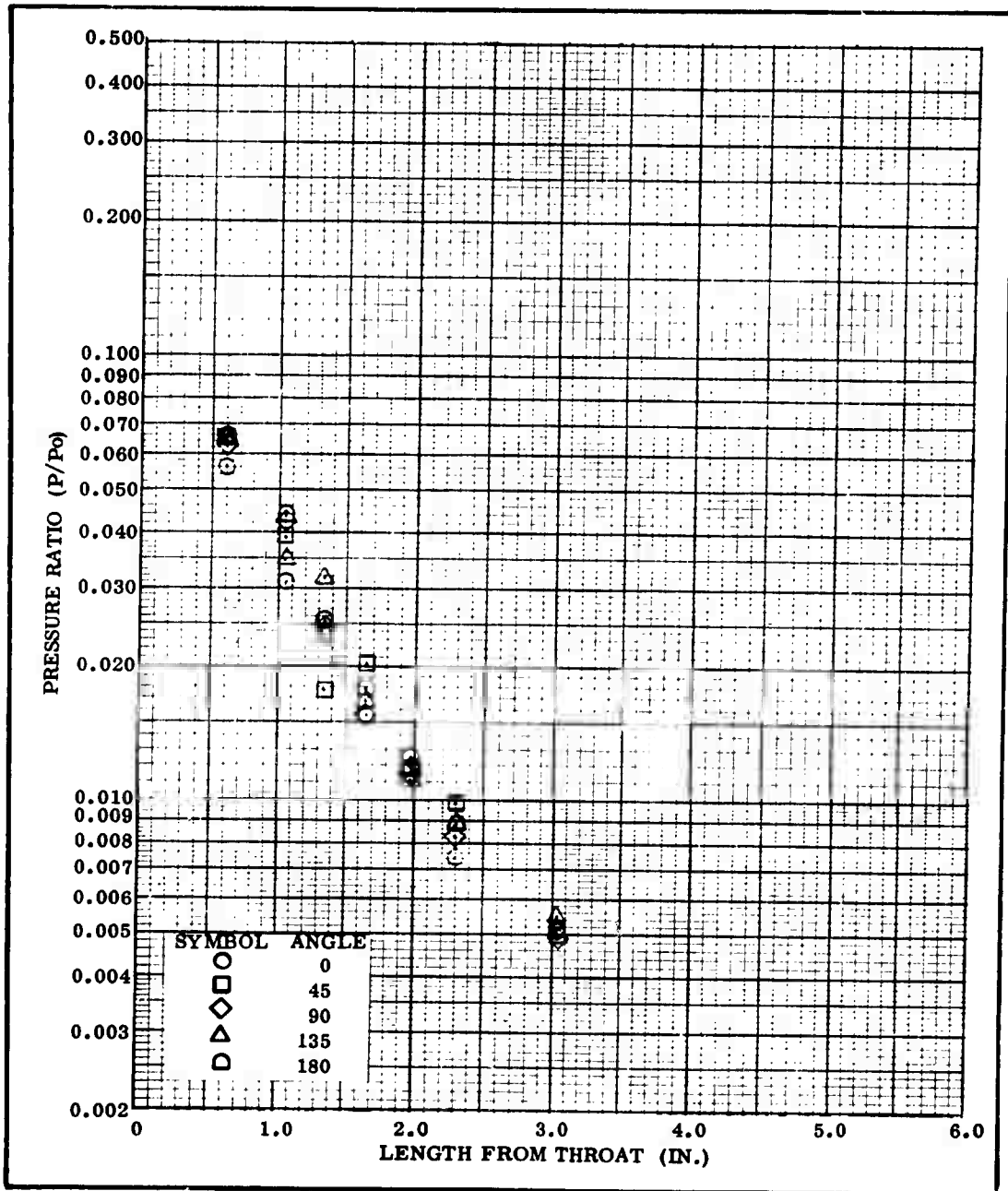Flex-X Cold Flow Run No. 22 , Vector Angle 0 Degrees

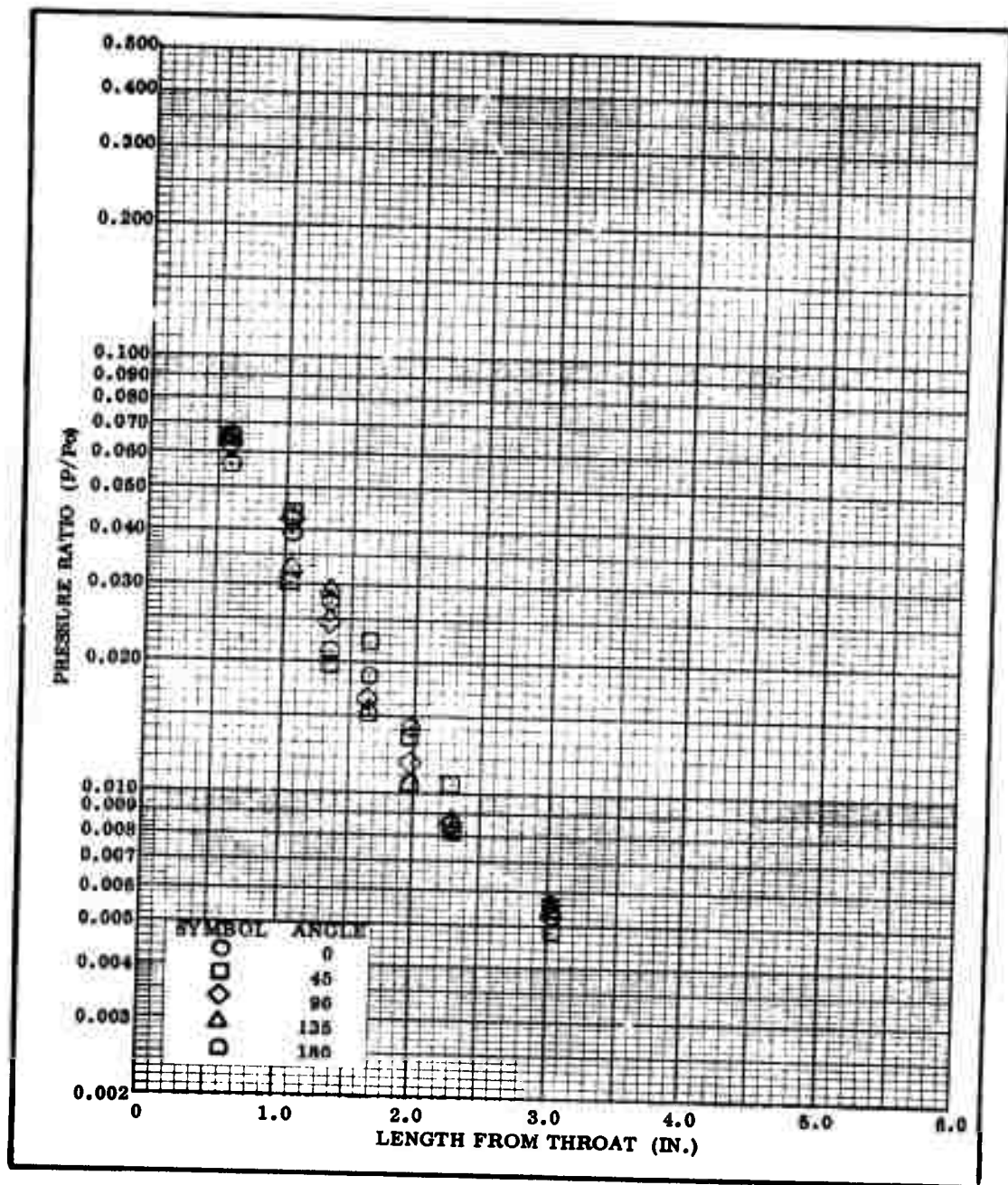Flex-X Cold Flow Run No. 22 , Vector Angle 2.5 Degrees

126

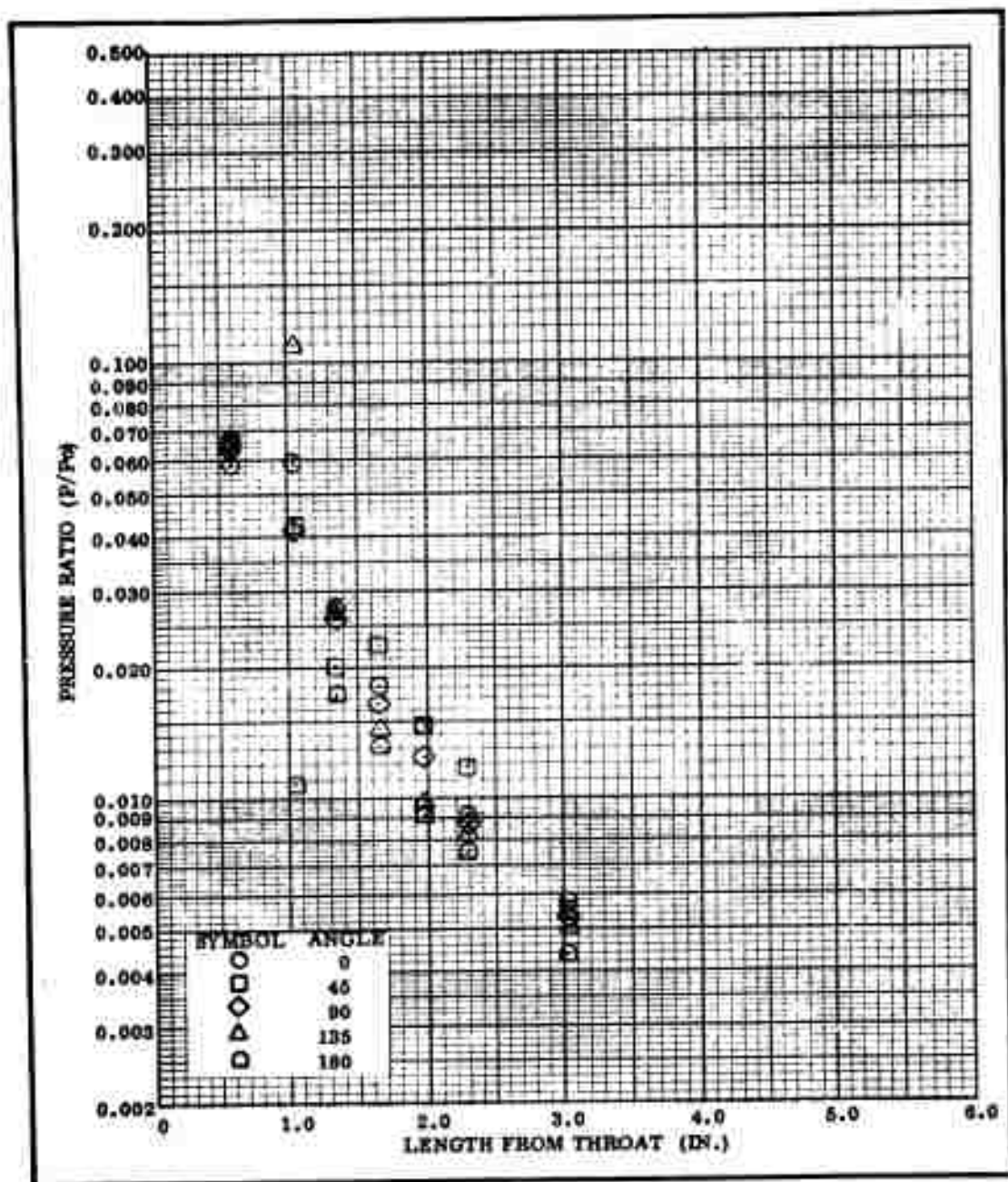Flex-X Cold Flow Run No. 22 , Vector Angle 5 Degrees

127

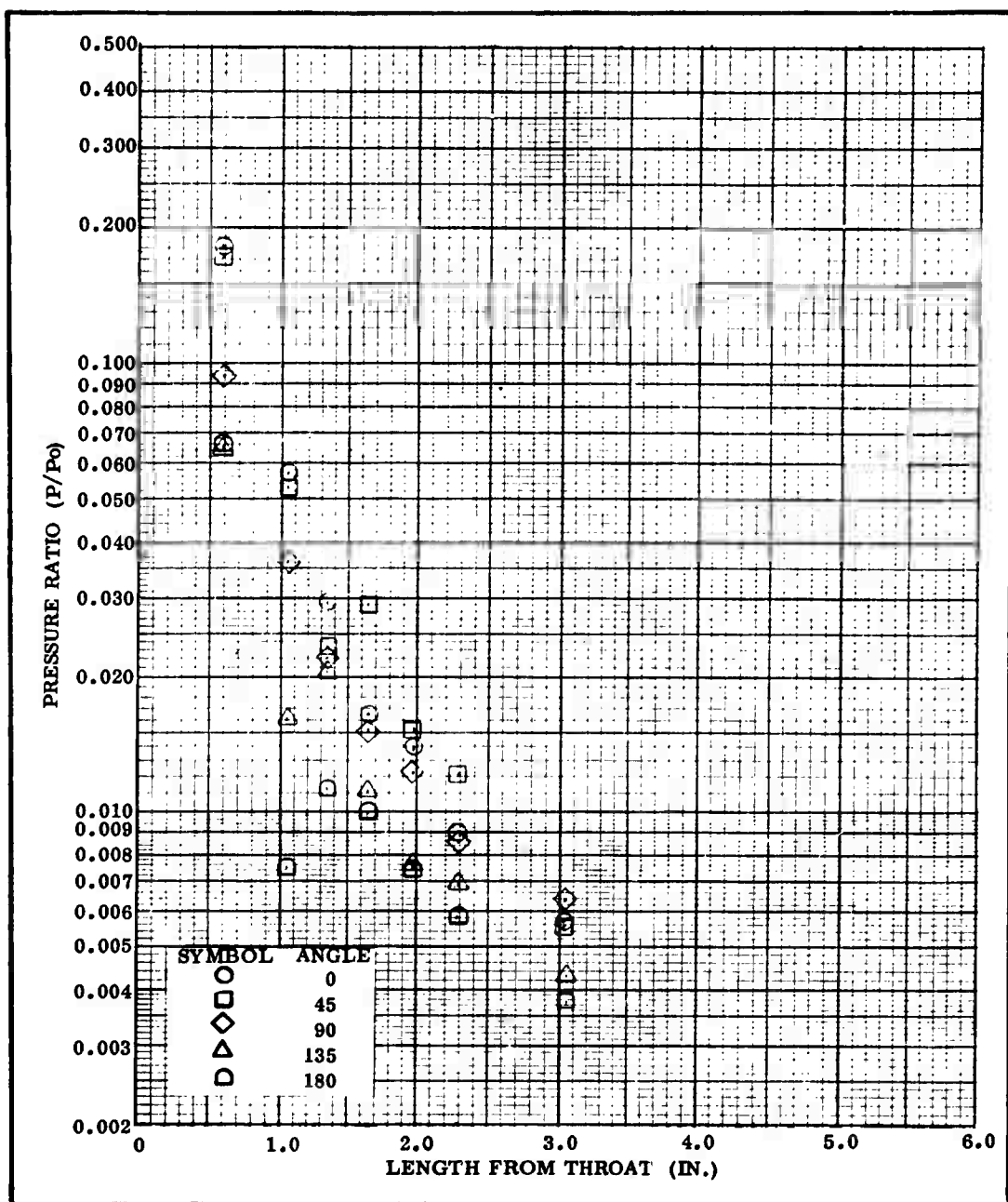Flex-X Cold Flow Run No. 22 , Vector Angle 10 Degrees

128

Flex-X Cold Flow Run No. 23, Vector Angle 0 Degrees

129

Flex-X Cold Flow Run No. 23 , Vector Angle 2.5 Degrees

Flex-X Cold Flow Run No. 23 , Vector Angle 5 Degrees

131

Flex-X Cold Flow Run No. 23 , Vector Angle 10 Degrees

132

Flex-X Cold Flow Run No. 24 , Vector Angle 0 Degrees

133

Flex-X Cold Flow Run No. 24 , Vector Angle 2.5 Degrees

134

Flex-X Cold Flow Run No. 24 , Vector Angle 5 Degrees

135

Flex-X Cold Flow Run No. 24 , Vector Angle   10 Degrees

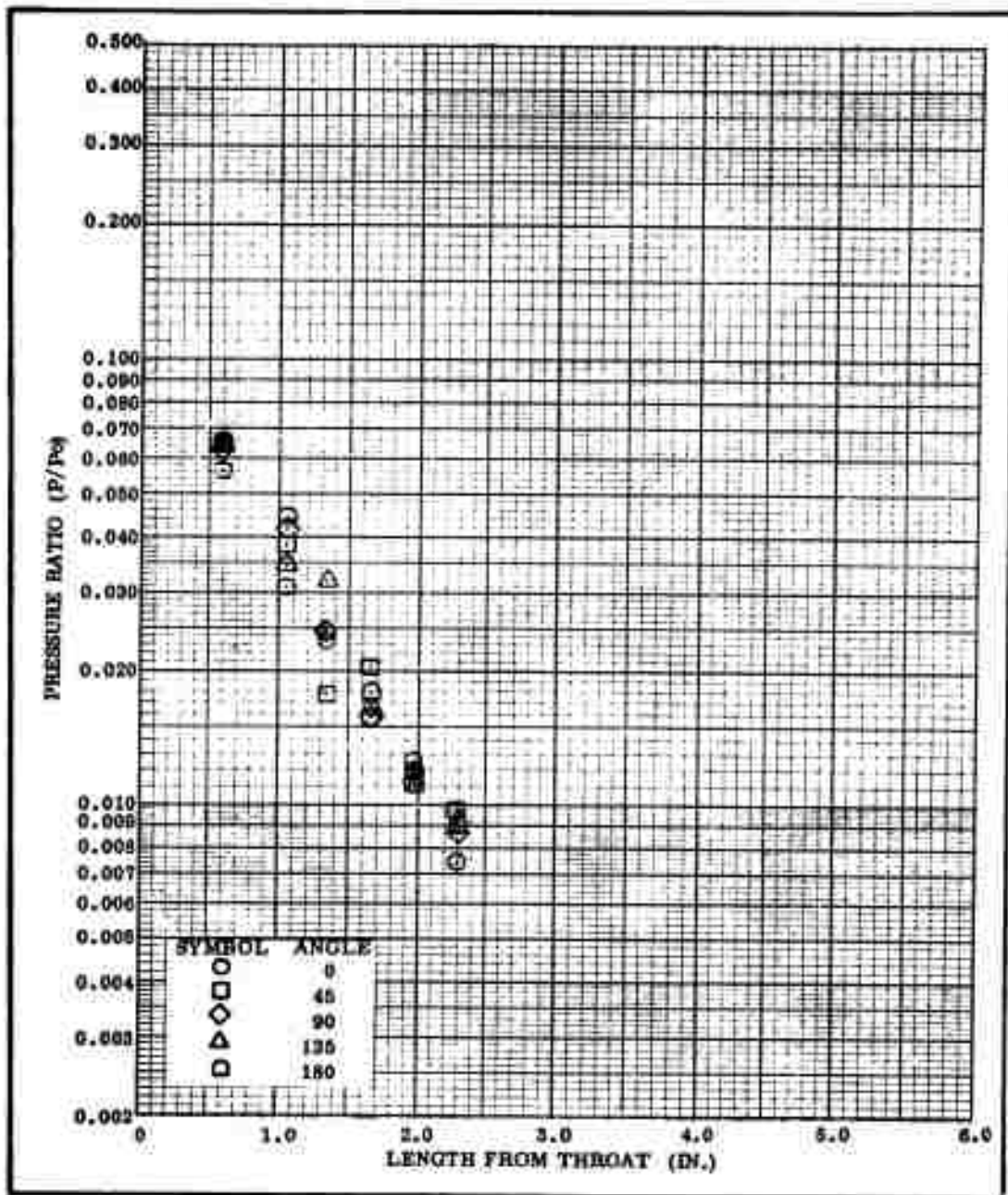Flex-X Cold Flow Run No. 25 , Vector Angle 0 Degrees

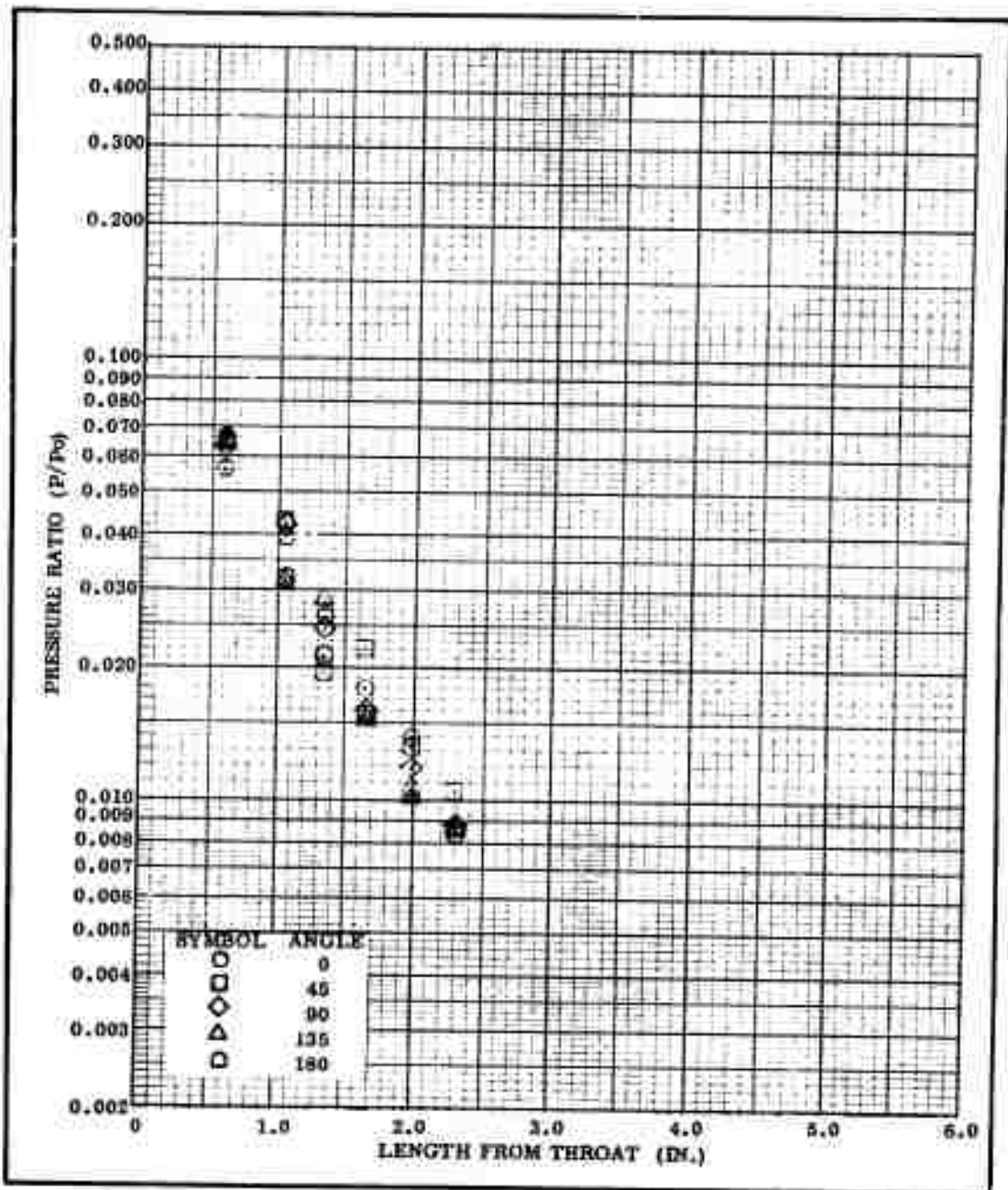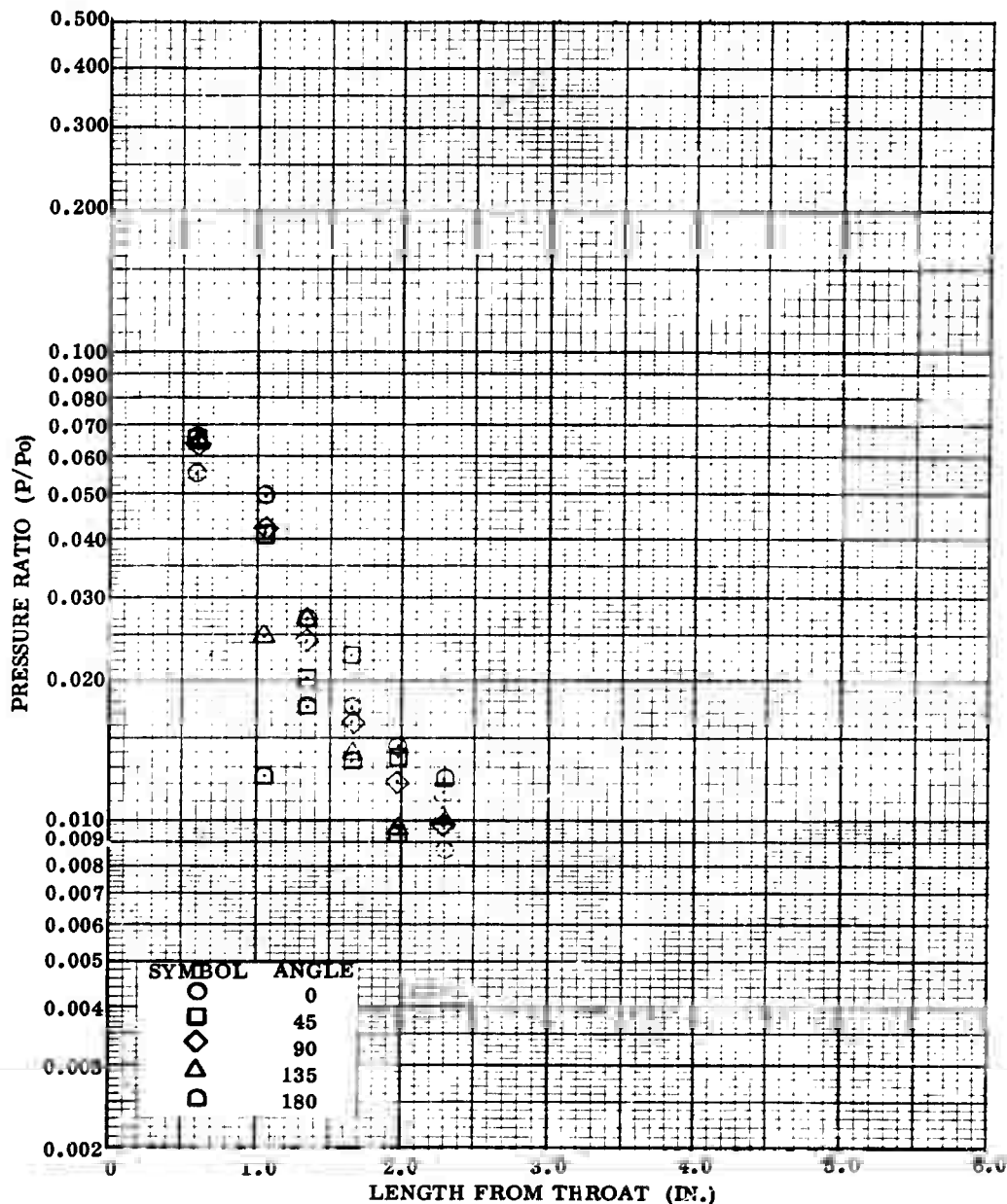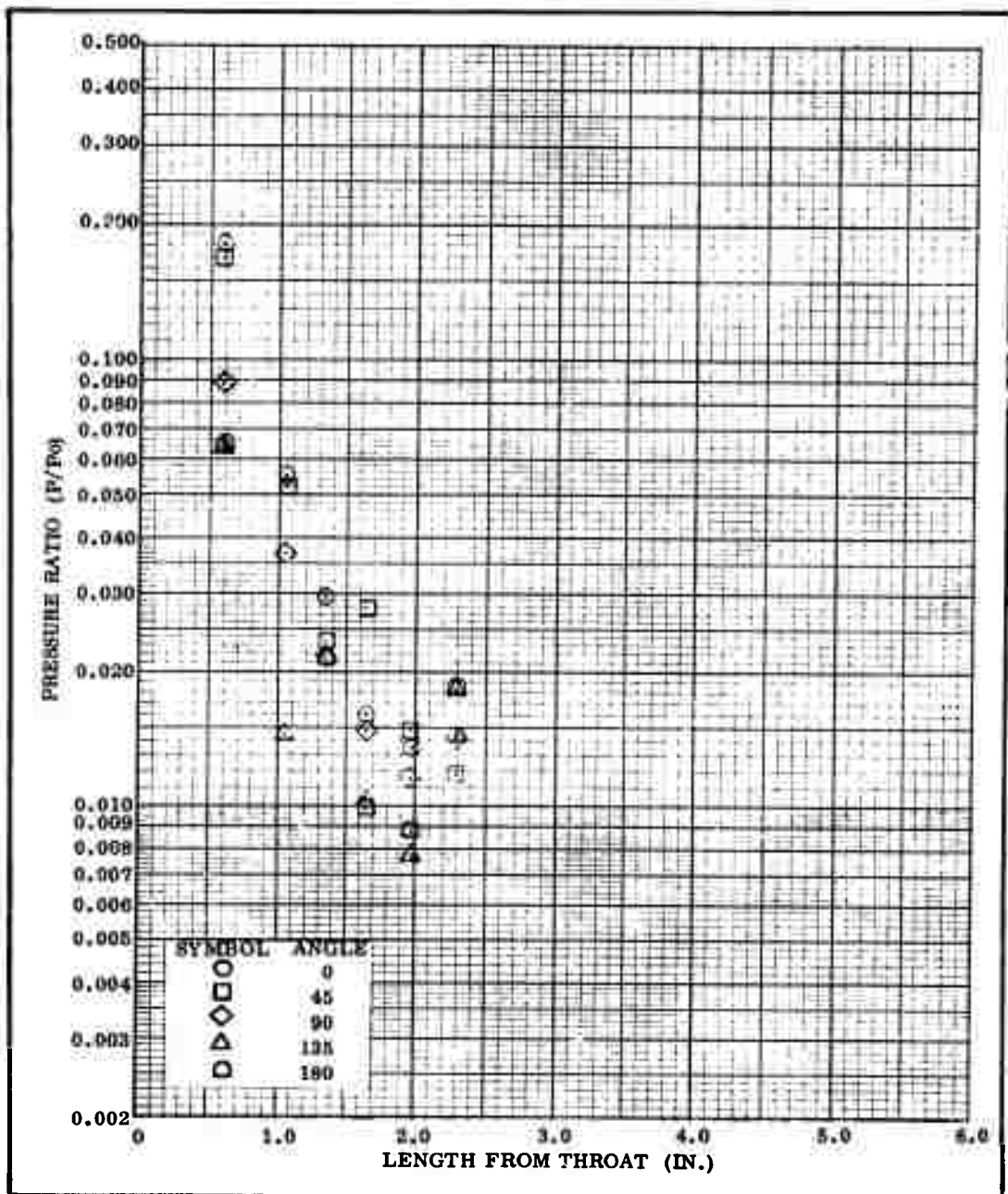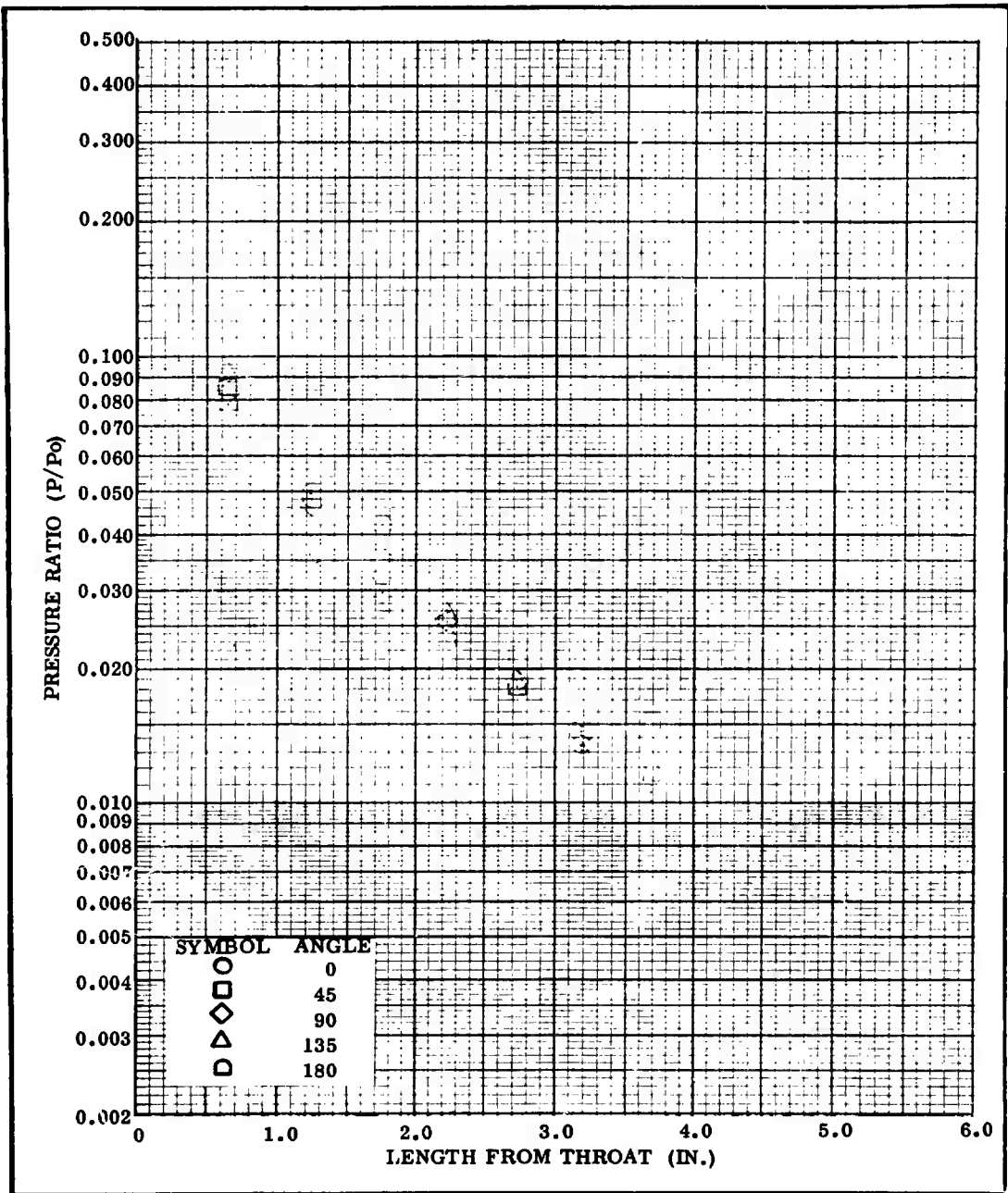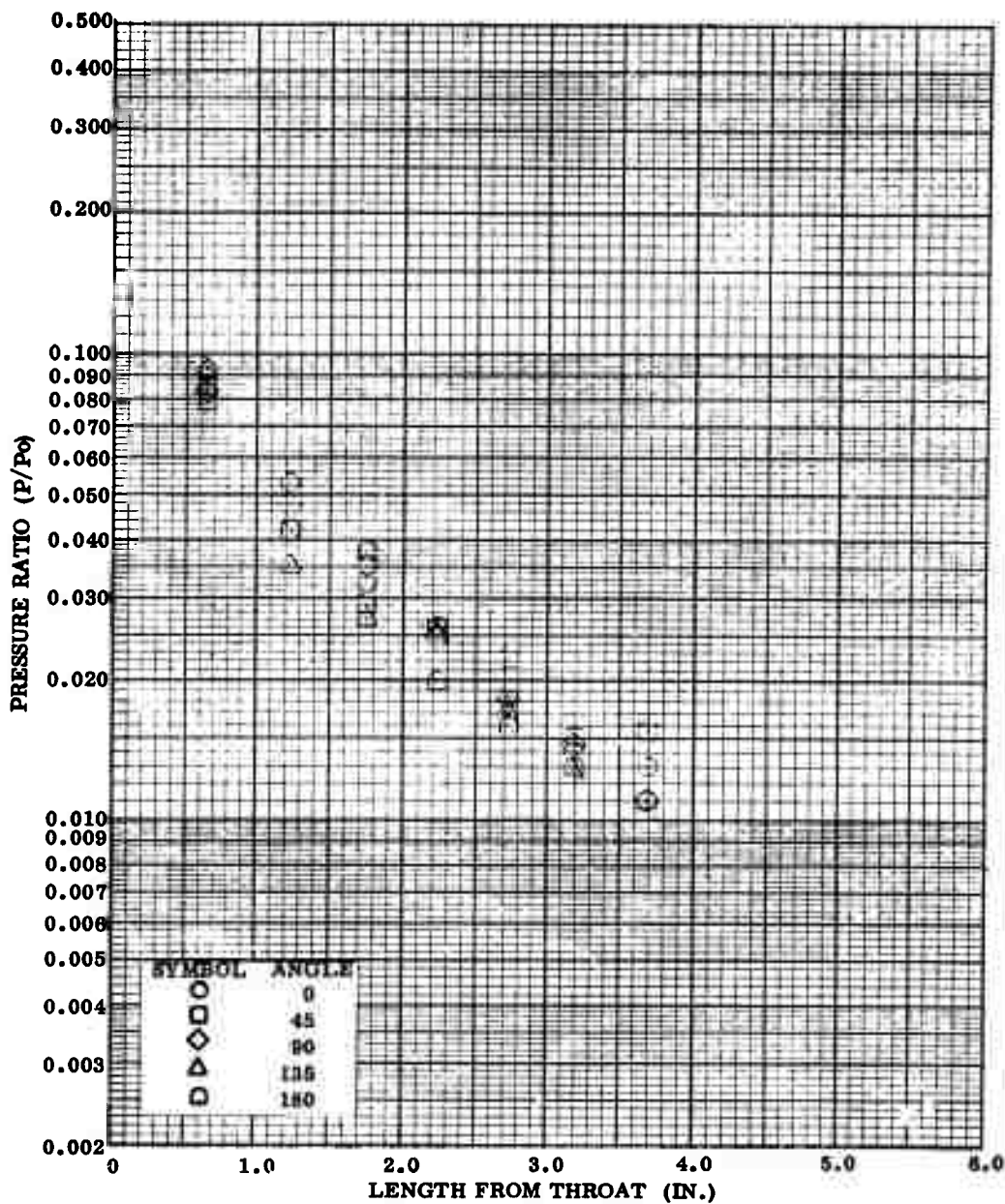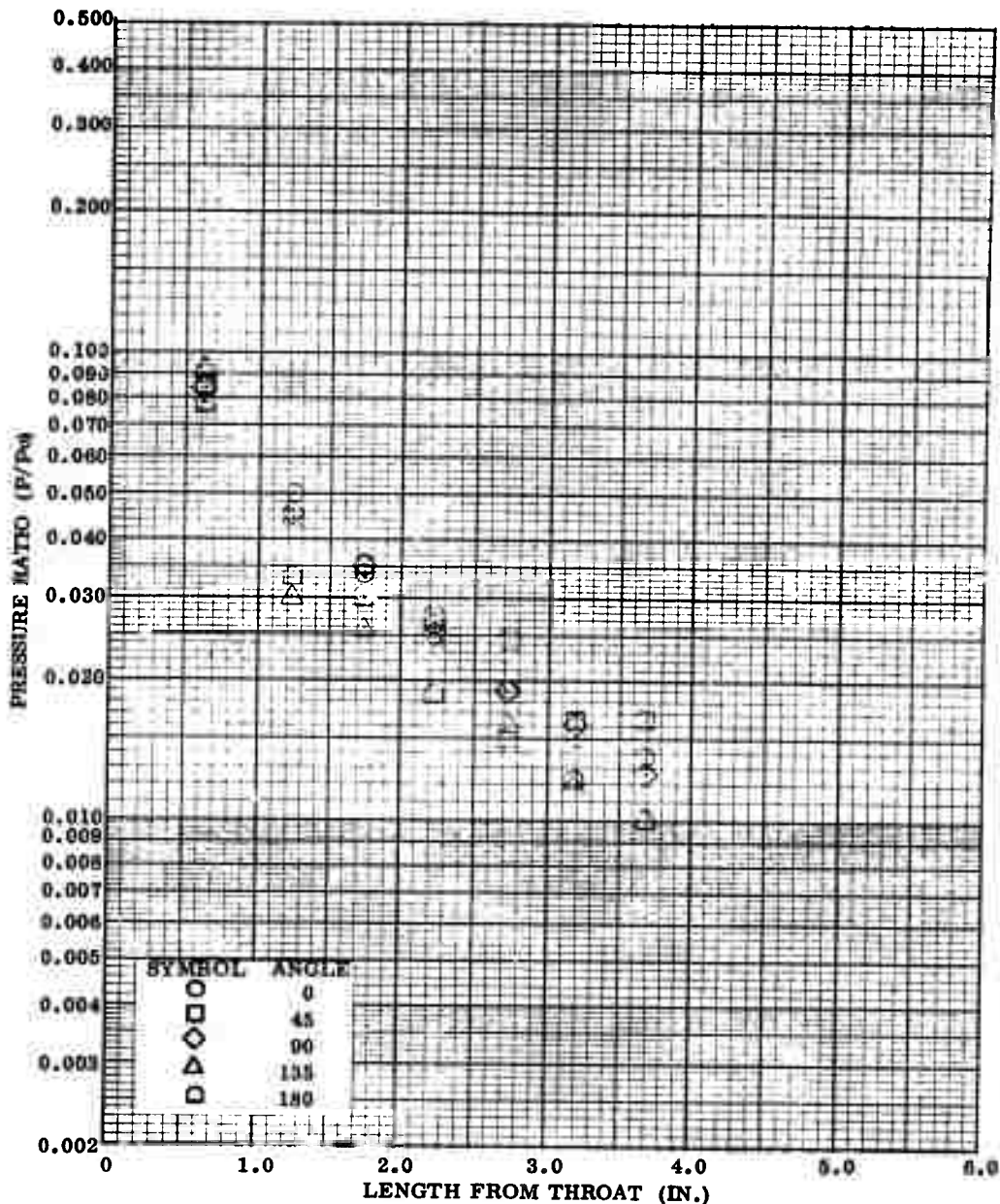Flex-X Cold Flow Run No. 25 , Vector Angle 2.5 Degrees
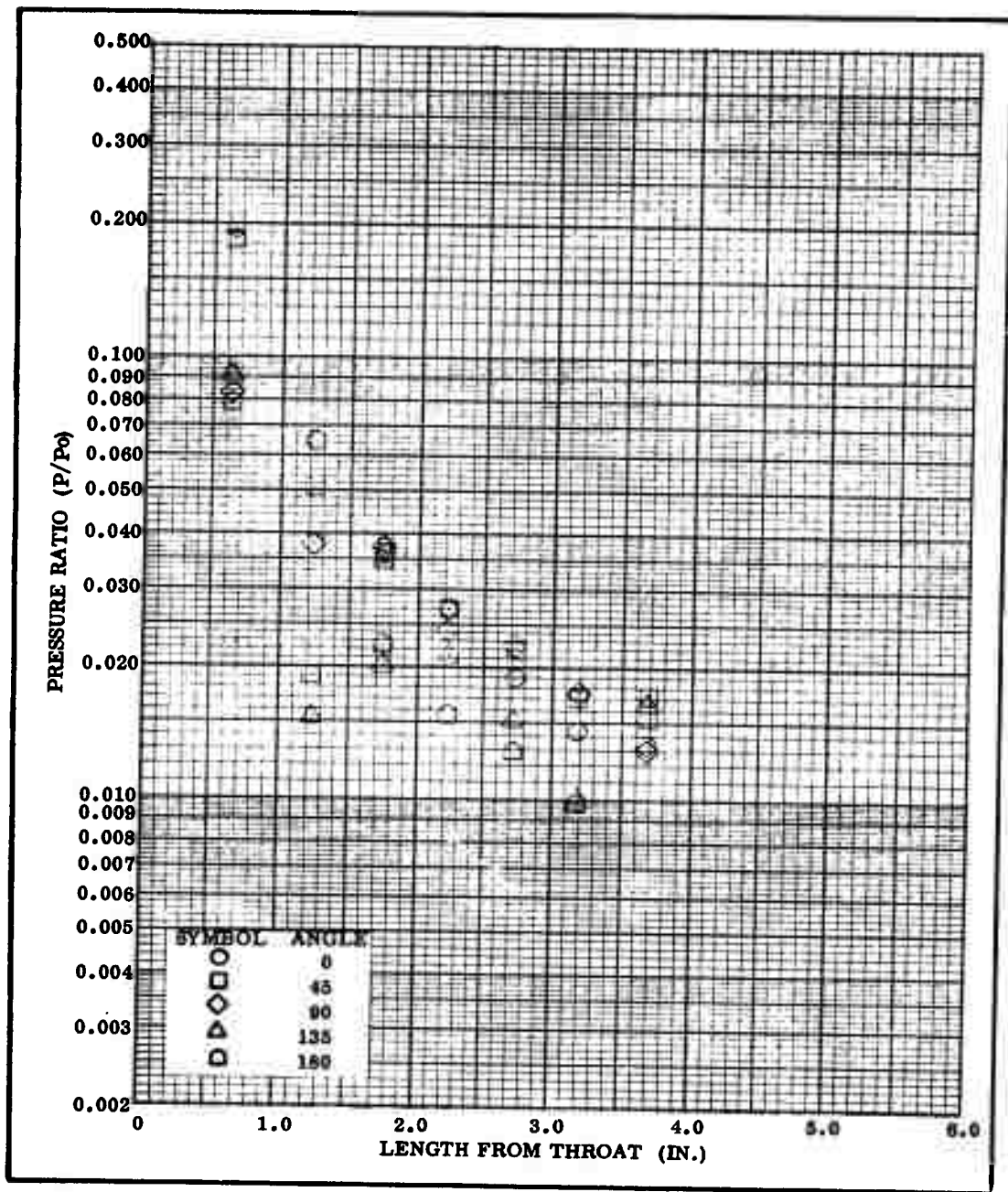
138

Flex-X Cold Flow Run No. 25 , Vector Angle   5   Degrees

Flex-X Cold Flow Run No. 25 , Vector Angle 10 Degrees
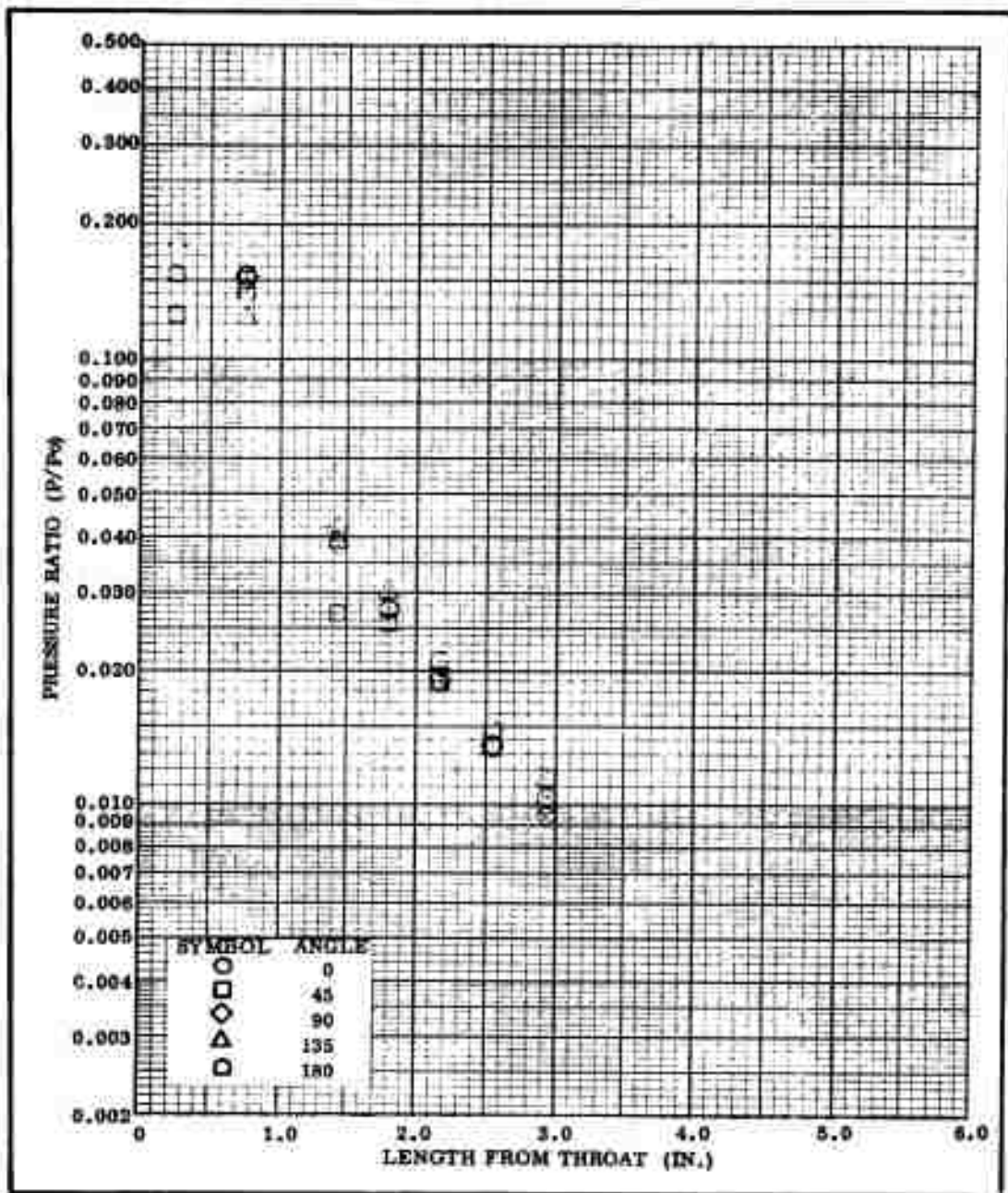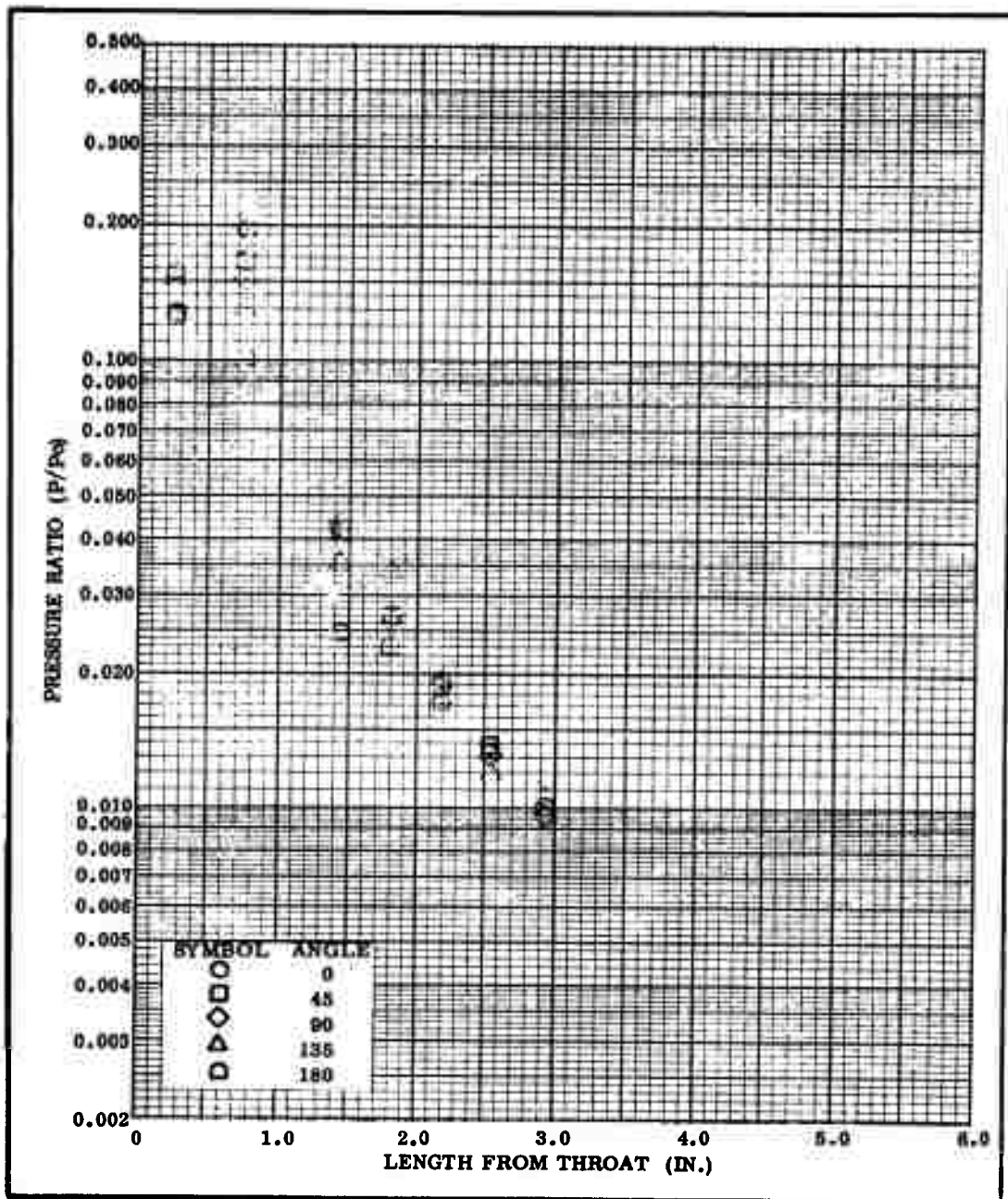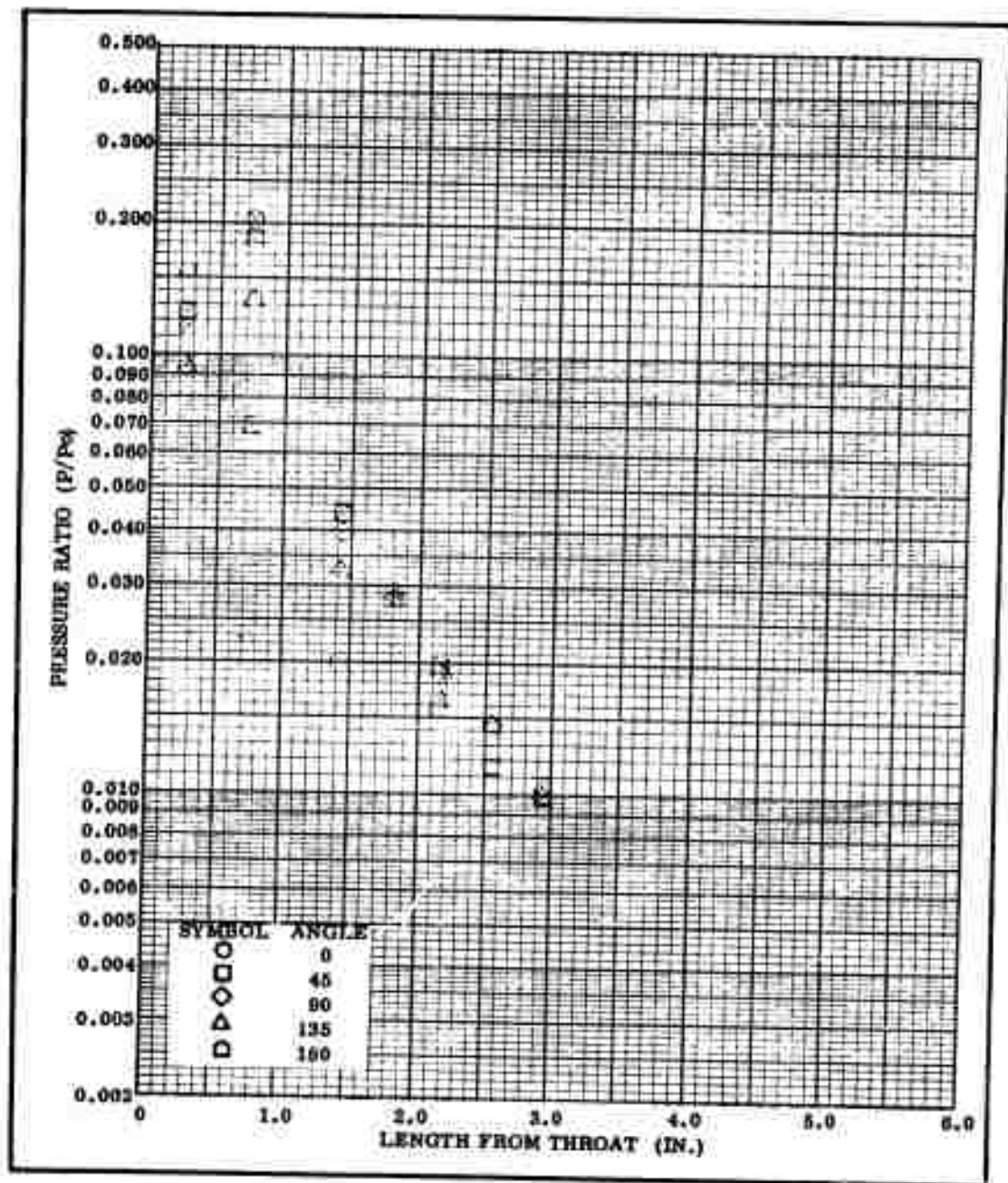
Flex-X Cold Flow Run No. 26 , Vector Angle 0 Degrees

Flex-X Cold Flow Run No. 26 , Vector Angle 2.5 Degrees

Flex-X Cold Flow Run No. 26 , Vector Angle   5   Degrees

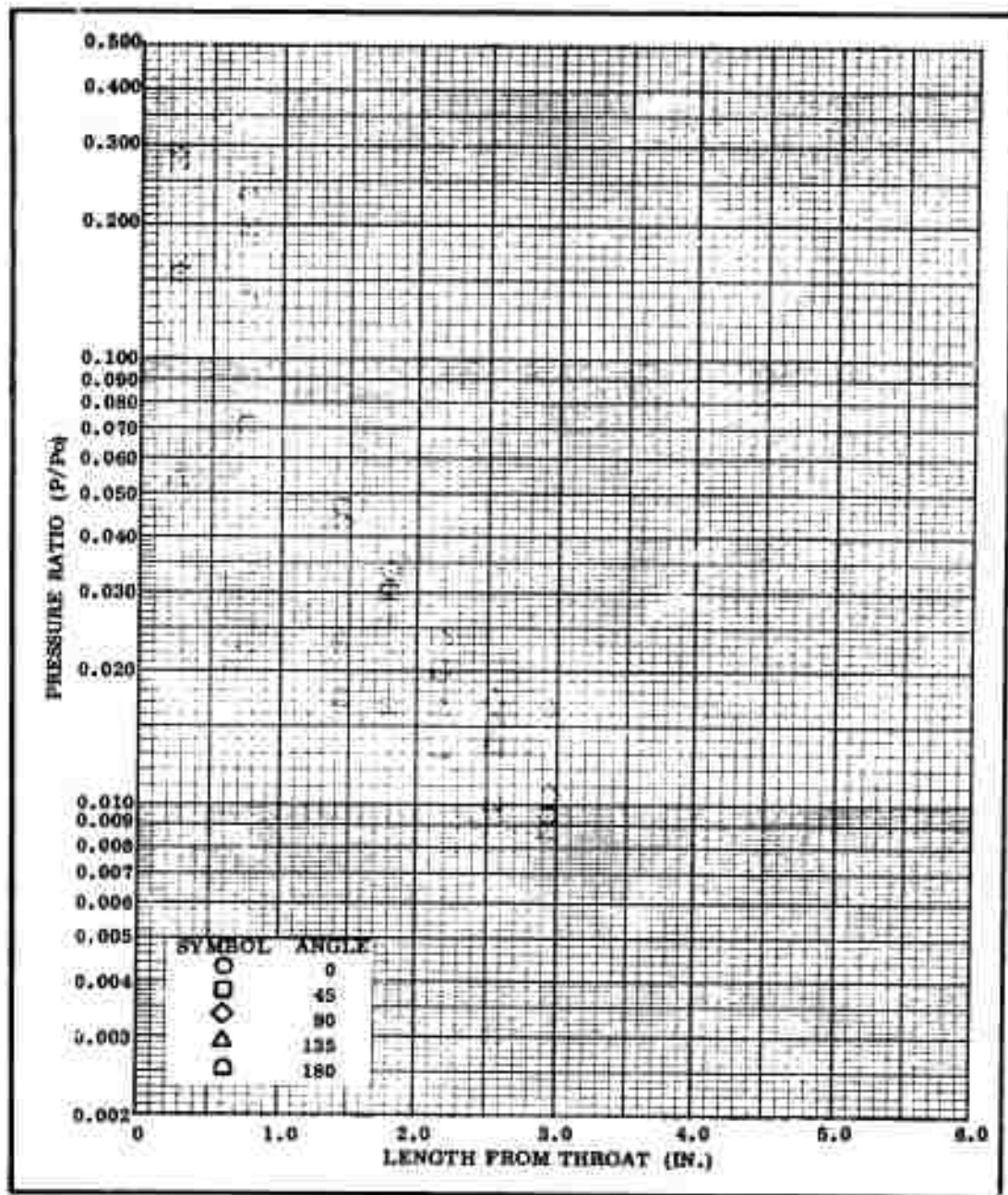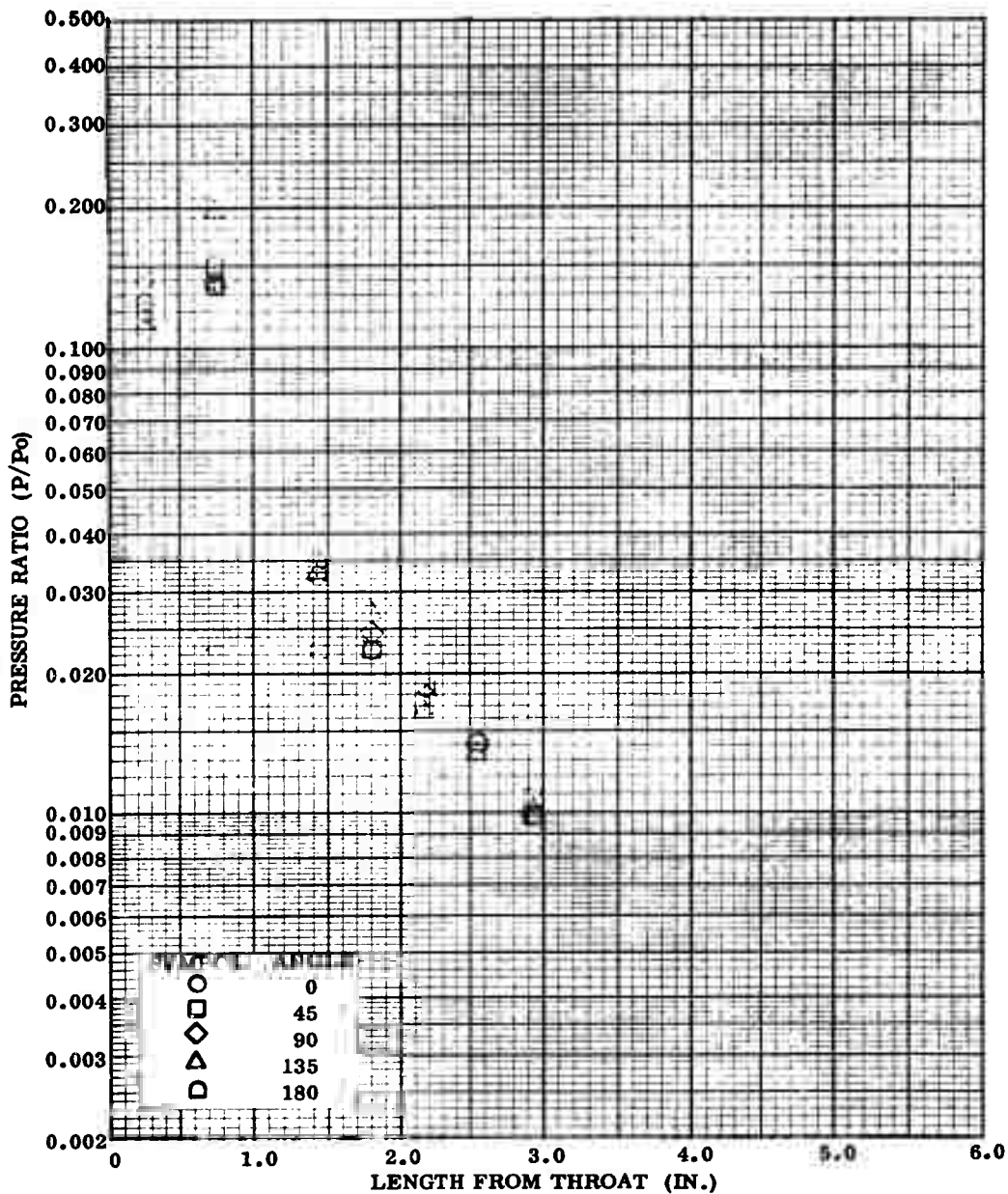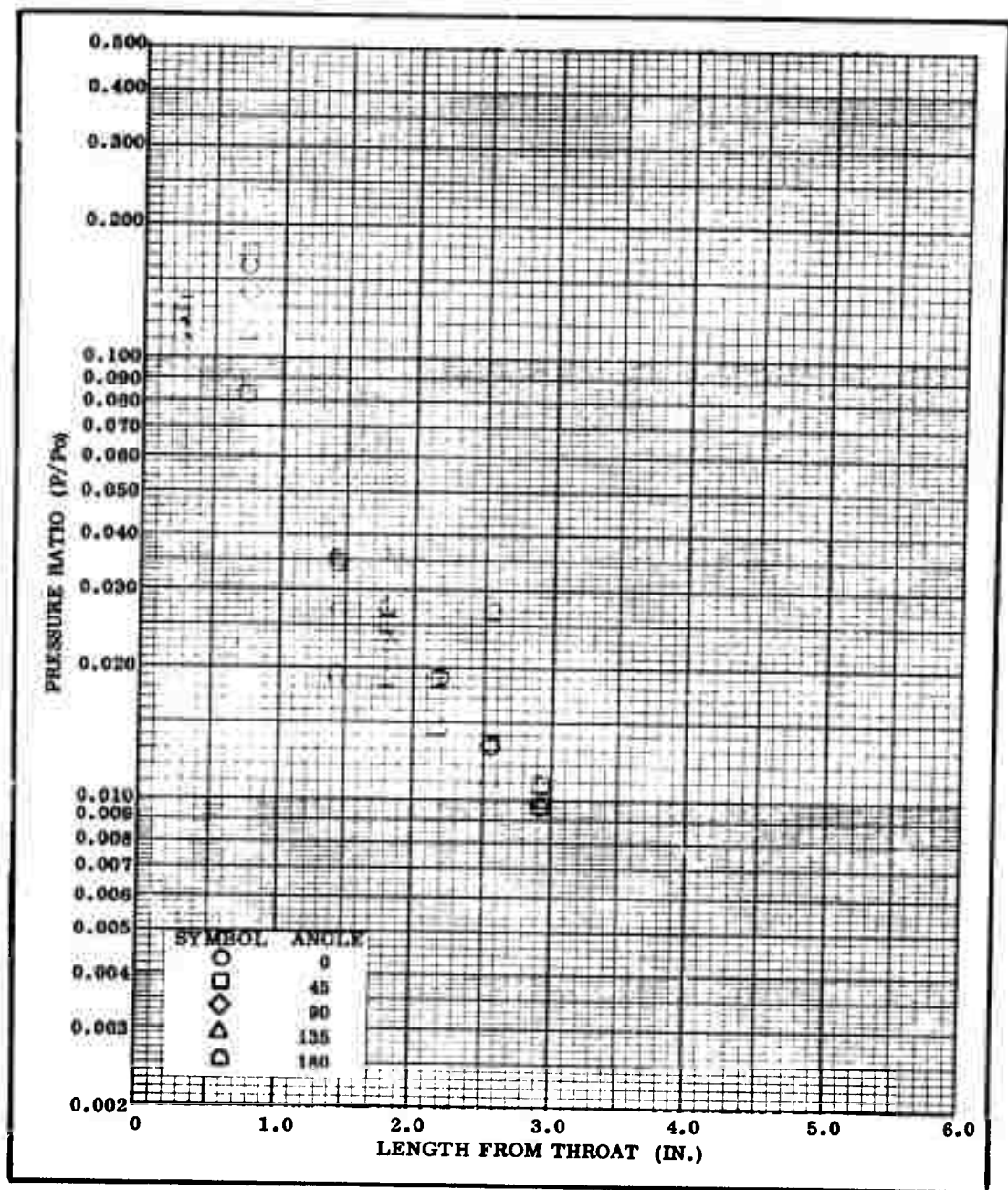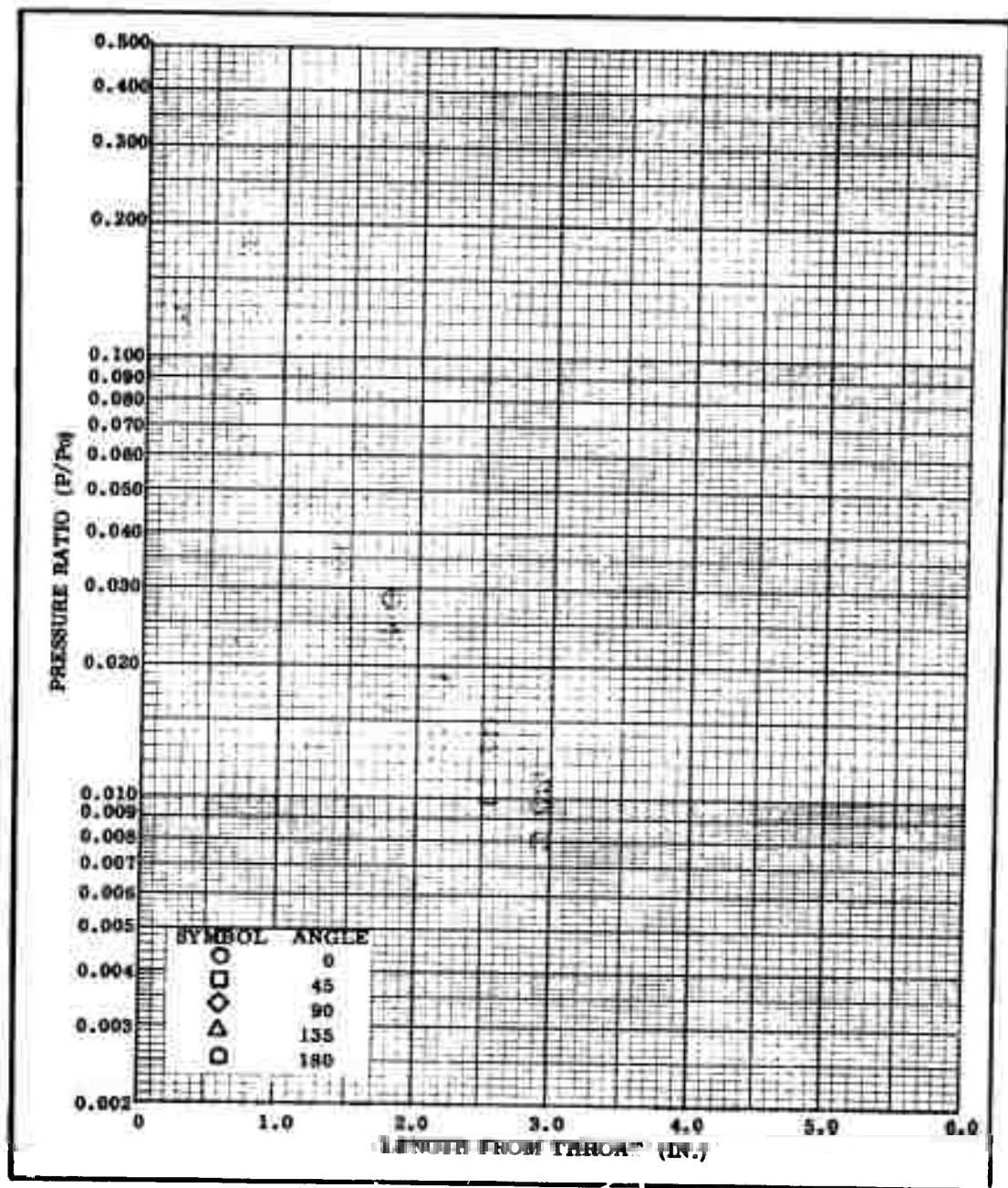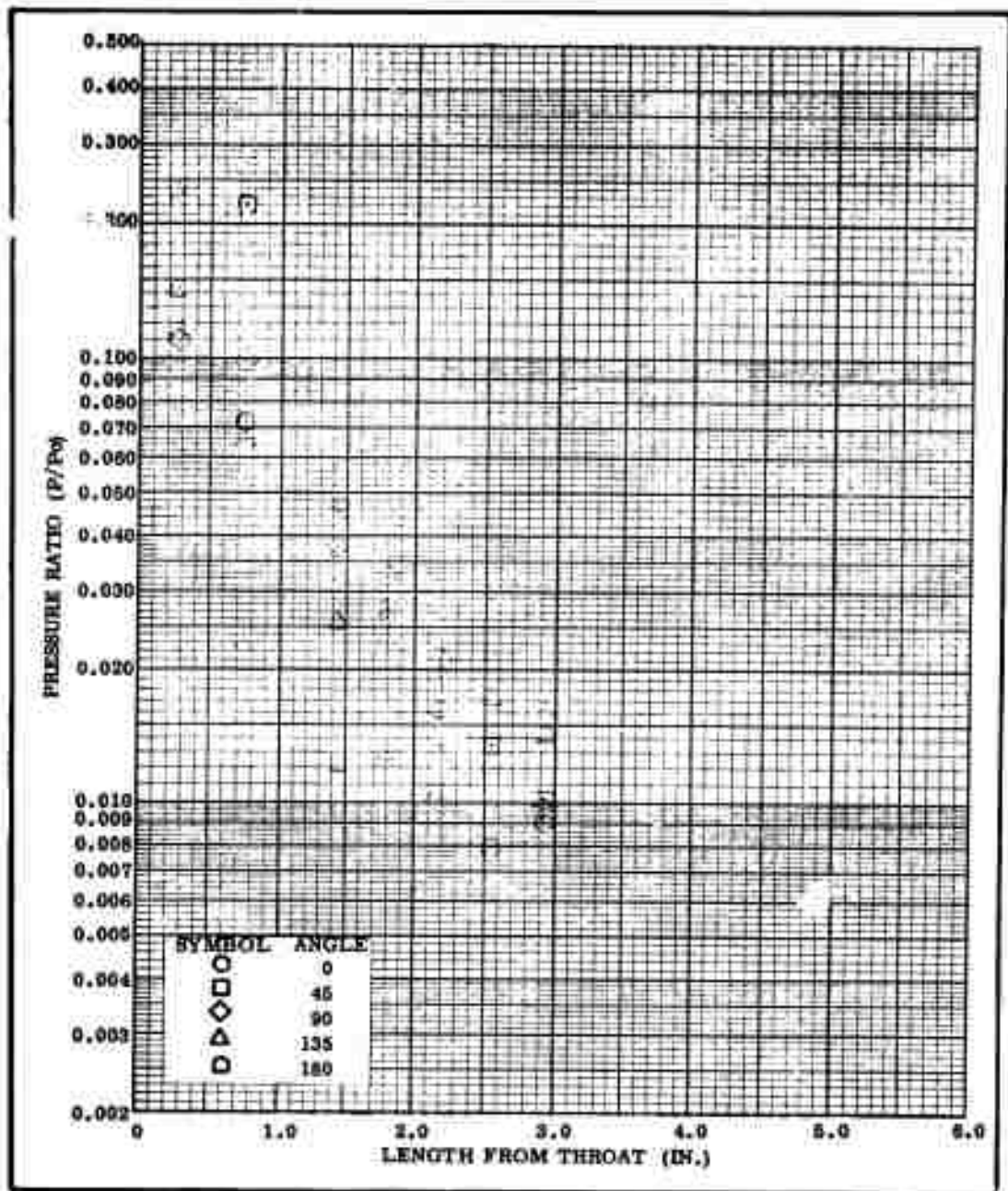Flex-X Cold Flow Run No. 26 , Vector Angle 10 Degrees

144

Flex-X Cold Flow Run No. 27 , Vector Angle 0 Degrees

Flex-X Cold Flow Run No. 27 , Vector Angle 2.5 Degrees

Flex-X Cold Flow Run No. 27 , Vector Angle 5 Degrees

147

Flex-X Cold Flow Run No. 27 , Vector Angle 10 Degrees

148